DISEASES *of the* CHEST

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Bronchiectasis and Its Management
A Report of 277 Cases

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Bronchiectasis is a common disease about which there is little unanimity of opinion as to the best form of treatment. While the development of pulmonary resection by improved thoracic surgical methods has permitted the radical cure of many cases, the common use of penicillin and other antibiotics has allowed a considerable vogue for medical and more conservative measures in handling other patients with this disease. This study was undertaken not to advocate any type of therapy over all others but rather to evaluate a fairly large group of patients treated by many methods and observed by one individual over a long period of time, and to describe the present policy in handling cases of bronchiectasis which has evolved from this experience.

The study includes 277 personally observed patients admitted to the Lahey Clinic between the years 1936 to July 1948. Since in the study and treatment of these patients there has been close cooperation between internist, roentgenologist, surgeon, otolaryngologist and bronchoscopist this has, in fact, been a group experience. Adams and Ficarra[1] have already reported on an appraisal of the surgical treatment of bronchiectasis in 50 cases which includes some of the patients in the present series. Since many persons are not candidates for surgery for one reason or another, the present group is larger and unselected except that there were a few additional patients whose records were not available for review.

The sexes (Table 1) are evenly divided and the ages range from 4 to 80 years. Age distribution (Chart 1) shows a remarkable uniformity throughout all decades up to age 50 except for the

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children who are in the minority among general clinic admissions. There are a surprising number of patients in the older group above 50.

The presenting complaint of patients on admission is shown in Table 2. The most frequent complaint was cough, occurring in 136 or almost half of the series. It is of interest that 33 came in chiefly because of hemoptysis. Most patients who come to the clinic because of this symptom eventually prove to have bronchiectasis. Weakness, fatigue and malaise not uncommonly are the predominant symptoms and in all such persons, as well as those with unexplained fever, bronchiectasis must be considered. Often the chief complaint was obviously unrelated to the pulmonary condition which at times was of secondary importance and therefore received no particular diagnostic or therapeutic attention because the primary disease took precedence.

TABLE 1

Bronchiectasis: 1936-1948

Number of cases	277
Male	135
Female	142
Youngest	4
Oldest	80

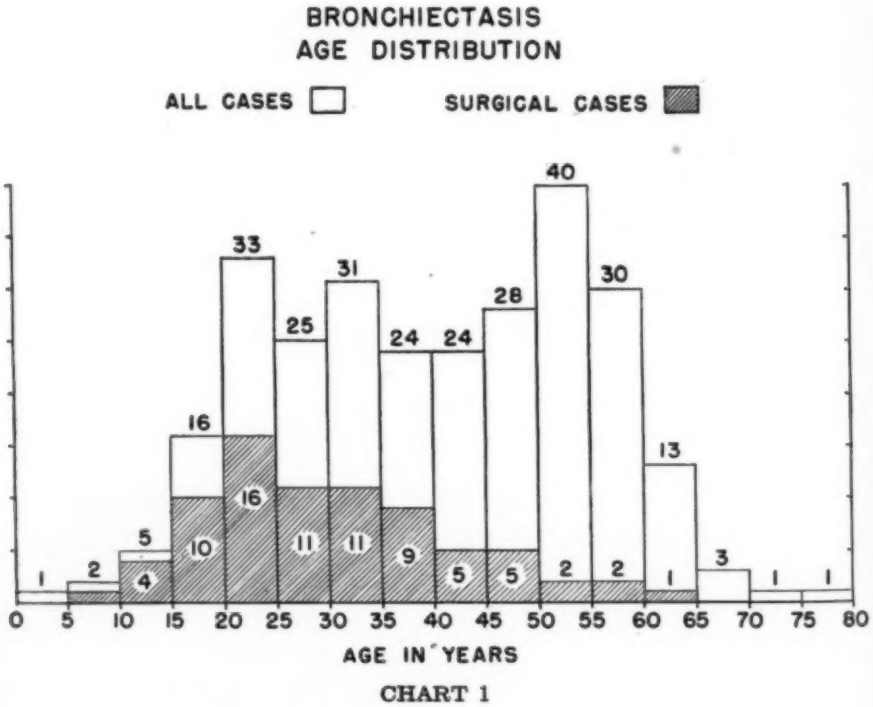

CHART 1

The chief symptoms of bronchiectasis are cough, sputum, hemoptysis, dyspnea and chest pain. Table 3 shows the number of times each of these occurred. Although almost all patients had cough, in 10 instances this complaint could not be elicited. Similarly, all but 23 patients had sputum. No attempt was made to record type or amount of sputum. It is our experience that sputum, though usually purulent, may be of any type, any amount from a teaspoonful to a pint or more daily and may even be intermittent, disappearing entirely for a period of time.

It is important to note that over half the patients had hemoptysis at some time during the course of the disease and there is no doubt that practically all patients with bronchiectasis expectorate blood some time during their lifetime. The amount of blood may vary from a tiny streak to a large exsanguinating hemorrhage. By far the commonest experience, however, is for the patient to raise a few mouthfuls of blood at infrequent and irregular intervals with long periods of freedom from this symptom. Hemoptysis occurred as the only symptom of any type in one case and without any other type of sputum eight times. This is characteristic of the so-called dry bronchiectasis in which infection is minimal or absent although the bronchi are dilated. Bronchiectasis, once productive of pus and mucus, may in the course of time

TABLE 2

Chief Complaint

Cough	136
Hemoptysis	33
Chest pain	11
Dyspnea	8
Asthma	8
Frequent colds	8
Malaise or fatigue	8
Sputum	4
Weakness	4
All other	57

TABLE 3

Five Major Symptoms

	Times Occurred	Times Chief Complaint
Cough	267	136
Sputum	254	4
Hemoptysis	154	33
Dyspnea	149	8
Chest pain	113	11
Patients with all symptoms	45	...

"improve" to this dry condition. Cough and hemoptysis occurred together as the only symptoms in 2 cases.

Three patients had cough only, without pain, sputum, hemoptysis or other complaint. Forty-five had all five of the major symptoms listed above. Dyspnea and pain both occurred often enough to be considered a common part of the symptomatology. One patient had no symptom that could be attributed to the bronchiectasis. She entered for a stricture of the bladder neck and was found to have persistent basal rales on physical examination and typical roentgenologic evidence of bronchiectasis.

Most of the patients (Table 4) had physical signs in the chest although these were often minimal, such as transient basal rhonchi or slight suppression of breath sounds over the affected lobe. Many times these physical signs were elicited only by repeated examinations. Probably of much more importance is the fact that 29 patients had absolutely no physical signs in the chest at any time by any observer. Even extensive bronchiectasis can exist without causing detectable physical signs.

Clubbing of the terminal phalanges which has long been considered a classical sign of bronchiectasis was not as frequent as might be expected, occurring only 53 times, often minimal in degree. Its presence should always lead to consideration of the possibility of bronchiectasis but its absence obviously has no value in ruling out the disease.

The pathogenesis of bronchiectasis in these cases was seldom clear cut. The onset was often insidious and early in life so that the patient had little recollection of the events leading up to the first symptoms. On the other hand, there were times when the disease seemed definitely to follow pneumonia or other respiratory infection, whooping cough, aspiration of a foreign body, and so forth. One patient's cough began immediately after he was rescued from drowning and seemed definitely related to aspiration or other consequence of this near tragedy. One seemed related to the partial bronchial obstruction caused by a large intrathoracic goiter. One patient's symptoms began after an attack of diphtheria requiring a tracheotomy. Three patients gave a history of inhaling mustard gas during World War I. These men usually gave a history of cough which had been considered to be tuber-

TABLE 4

Physical Signs

Pulmonary	243
Clubbed fingers	53
No physical signs	29

culous and was treated as such. Finally, bronchograms confirmed the diagnosis of bronchiectasis. The two cases of foreign body will be mentioned later.

Recent studies[2] have confirmed the opinion that bronchial obstruction and infection are two of the most important factors in the etiology of bronchiectasis, so situations which might cause either of these were considered of possible historical interest. Table 5 shows the number of times these factors were found. The high incidence of pneumonia and pleurisy is striking. It is impossible to determine in most cases no matter how carefully the patient is questioned whether pneumonia caused the bronchiectasis or occurred because the patient had bronchiectasis. It has frequently been observed that patients who have bronchiectasis are extremely susceptible to pneumonia or pneumonitis and sometimes have such complications almost annually. In fact, the history of frequent attacks of pneumonia should in itself lead to a strong suspicion of bronchiectasis. The charts examined undoubtedly record whooping cough much less frequently than its actual incidence and probably this disease is frequently the inciting cause of bronchiectasis beginning in childhood.

Although most asthmatics do not have bronchiectasis, some patients with asthma of long standing develop the cylindrical type as a result and it is inevitable with the high percentage of allergic individuals in this country that mere coincidence would account

TABLE 5
Etiologic Factors

Pneumonia	159
Pleurisy	106
Asthma	20
Whooping cough	15
Tuberculosis	13
Post-tonsillectomy	5
Empyema	5
"Flu"	4
Mustard gas	3
Measles	3
Postoperative pneumonia	3
Foreign body	2
Emphysema	2
Situs inversus	2
Tooth extraction	1
Pulmonary abscess	1
Trauma	1
Tracheotomy	1
Large goiter	1
Near drowning	1

for both asthma and bronchiectasis being present in some patients. Table 6 shows that 52 of our patients had allergic manifestations personally and 48 had family histories of allergy. This is probably not more than the number to be expected by pure coincidence. However, the importance of this observation lies in the fact that treating the allergy is often an important part of the therapy and in some cases may make the difference between success and failure.

All patients in this study had roentgenograms of the chest at least once. These were either single or stereoscopic postero-anterior projections, often with special positions and technics to augment the study. Plain roentgenograms before the instillation of iodized oil were considered abnormal in a high percentage of cases. Two hundred and fifty-one were abnormal in some respect and usually the proper diagnosis was at least suggested by the roentgenologist (Table 7). In our experience, bronchiectasis can be diagnosed accurately from such studies in most cases and bronchography with iodized oil serves as a means of confirming the diagnosis and, more important, is the only method by which its extent and segmental distribution can be accurately mapped. Again of importance are the patients who showed no evidence of disease even on careful roentgenologic study. In 26 cases there was nothing abnormal on the roentgenogram even after the diagnosis had been proved and the films were reviewed. Therefore, the finding of a completely normal roentgenogram cannot be considered to rule out bronchiectasis when there is reason to suspect it.

Lipiodol bronchograms were made on 196 patients, sometimes more than once. These were always abnormal, the diagnosis of

TABLE 6

Allergy and Bronchiectasis: 277 Cases

Patient allergic, family nonallergic	29
Patient allergic, family allergic	23
Patient nonallergic, family allergic	25
Patient nonallergic, family nonallergic	200

TABLE 7

Diagnostic Studies: 277 Cases

X-rays abnormal	251
X-rays normal	20
X-rays questionable	6
Bronchograms	196
Bronchoscopies	101
X-rays only	70
X-ray and bronchogram (no bronchoscopy)	99
X-ray and bronchoscopy (no bronchogram)	8
Neither x-ray nor physical signs	9

course not being made unless dilated bronchi were visualized. In 101 cases, bronchoscopy was performed. Usually this examination was followed by bronchography, but in 8 cases iodized oil was not used, the information obtained from bronchoscopy alone being considered adequate for the purpose. In 71 cases the plain roentgenogram was considered sufficient for diagnosis without further study. Ninety-nine patients had bronchography but not bronchoscopy.

Bronchography is considered a necessary procedure prior to pulmonary resection and it has become our practice, evolved through experience gathered from the patients herein reported, to insist that all five pulmonary lobes be visualized prior to operation so that an accurate base line is obtained from which to judge how much surgery to advise and to evaluate postoperative results and complications. In three cases early in the series, bronchograms were not done before surgery although bronchoscopy had been performed. On the other hand, we usually have no qualms about advising surgery without bronchoscopy provided bronchograms have been successful and no lobe or segment is obstructed. Roentgenologic evidence of tumor or atelectasis, nonfilling bronchi to a lobe on the bronchographic study, and the clinical finding of wheeze are considered urgent indications for preoperative bronchoscopy, but often, it is done in patients without these findings. Operations were performed on 32 patients who had bronchograms but no preoperative bronchoscopy.

One patient had neither bronchoscopy nor bronchogram and deserves special mention. This man of 34, entered because of asthma and was found on routine roentgenography to have a rounded mass in the left upper lobe which appeared to be a tumor (Fig. 1). A left upper lobectomy was performed and the mass pathologically was found to be not a tumor but a single large bronchiectatic cavity with squamous metaplasia of the lining epithelium. His subsequent course was uneventful although his asthma was an unrelated problem.

An interesting and important small group of patients is that in which there were neither abnormal physical nor roentgenologic signs. In these cases the symptoms were suggestive enough to lead to bronchography in spite of the otherwise negative findings and bronchiectasis was proved.

Many patients did not require bronchography or bronchoscopy because the diagnosis could be made with accuracy by the simpler methods and because it was apparent that surgery could not be offered because of age, extent of disease or generally poor condition. It was not necessary in these cases to delineate the segmental distribution of the disease to institute treatment. Some came for

confirmation of advice given elsewhere, or refused further study or had another condition which was more important than the bronchiectasis. In these cases bronchograms and bronchoscopies were usually omitted.

The lower lobes were involved much more frequently than the others, the middle lobe and lingular segment of the left upper lobe somewhat less frequently and the upper lobes least often (Table 8). The total number of left lobes (295) was almost exactly equal to the number of right lobes (292). A single lobe was involved exactly 100 times (Table 9), two lobes 86 times, three lobes 50 times, four lobes 21 times, five lobes twice and six lobes six times. For practical surgical reasons the lingula has been listed here as a separate lobe although anatomically it is a dependent portion of the lower anterior part of the left upper lobe. In 121 cases the disease was bilateral, in two the entire right lung was involved with normal left lung and in 9 the entire left lung was diseased while the right remained normal.

An effort has been made to determine whether the lower lobes are usually involved alone or in conjunction with the adjacent middle lobe and lingular segment. In the cases in which bronchograms were done, when the right lower lobe was involved, the

FIGURE 1: Bronchiectatic cavity in left upper lobe with squamous metaplasia of epithelium appearing to be a tumor.

middle lobe was also diseased in 65 cases but in 40 cases it was normal. On the left side the lingula was involved with the lower lobe 63 times and uninvolved 78 times. In addition, it could be determined that when the apical portion of the left upper lobe was diseased the lingula was similarly diseased 18 times and was uninvolved only six times.

Thirteen patients gave a history of having had tuberculosis. This could not always be confirmed. Some of these patients had no clinical or roentgenologic signs of tuberculosis, either healed or otherwise, and had sputa repeatedly negative for acid fast organisms. On the other hand, several patients were discovered to have previously undetected roentgenologic evidence of old healed lesions. In all, 24 cases were found in which tuberculosis was present, usually as a healed scar of obsolescent disease but at times definitely of etiologic importance in producing the bronchiectasis. One patient had tuberculosis of the spine and an unrelated nonspecific bronchiectasis. One other is of special interest. This patient, a young woman of 19, entered the clinic in 1945 complaining of cough of many years' duration. As a child she had spent a total of almost two years in a tuberculosis sanatorium because of her symptoms but all studies had been negative and she was finally discharged as nontuberculous. Our roentgenograms, bronchoscopy and bronchography established the diagnosis of bilateral bronchiectasis and as the first stage of a contemplated

TABLE 8

Lobes Involved

Right upper	25	292
Right middle	103	
Right lower	164	
Left upper	26	295
Lingula	75	
Left lower	194	

TABLE 9

Number of Lobes Involved

One	100
Any two	86
Any three	50
Any four	21
Any five	2
All six	6
Unilateral disease	145
Bilateral disease	121

bilateral surgical procedure, a right middle lobectomy was done. Recovery was uneventful but when she returned for study prior to the second operation her sputum was found to contain tubercle bacilli. Roentgenograms (Fig. 2) showed an infiltrative lesion at the apexes which at first was thought to be retained lipiodol but which further study indicated was increasing in amount. Guinea pig inoculation of the sputum confirmed the tuberculous nature of the disease, cavitation in the left (unoperated) lung developed and in spite of streptomycin and sanatorium care, she went rapidly down hill to death within a few months after the tuberculosis was first diagnosed. Since as far as could be determined there had been no recent exposure to the disease, it was conjectured that she probably had a small healed tuberculous focus in the lung which was lighted up by the surgical procedure. Such a latent focus presumably could have been acquired during her long sojourn in a sanatorium as a child. Although this unhappy outcome seemed unavoidable, it points out a danger which should always

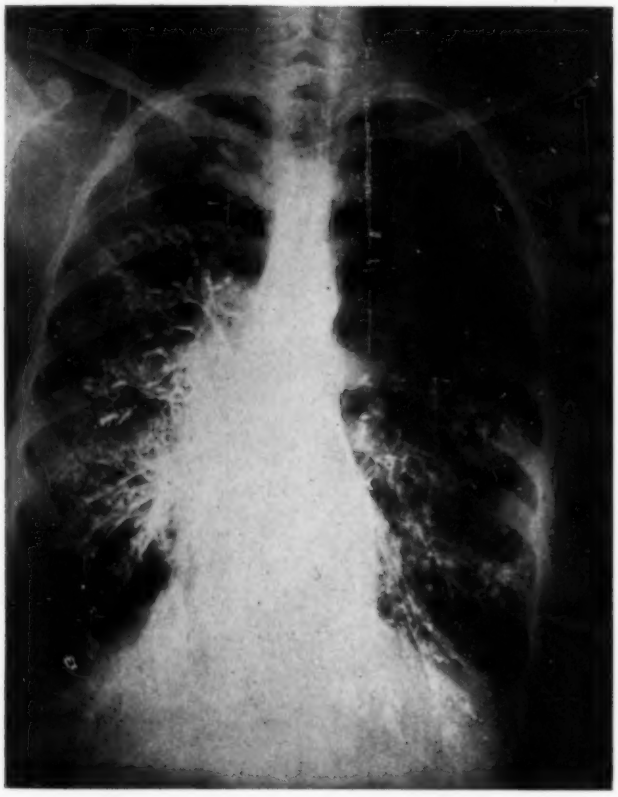

FIGURE 2: Bronchogram after right middle lobectomy showing bronchiectasis in both lower lobes. Note exudative tuberculosis in both apexes and first and second right interspaces.

be considered before surgical extirpation of a portion of a lung which has ever been involved by tuberculosis.

A bacteriologic study of the sputum revealed a great variety of infecting organisms. Ninety-three patients had such studies. Rarely was only one type of organism isolated and multiple cultures on the same patient frequently revealed different bacteria. Twenty-nine species of bacteria and five fungi were identified. There was no reason to associate any particular microorganism or any combination of such with any type or severtiy of disease. On the other hand, the appearance, color, quantity and odor of sputum may be an indication of its bacteriologic content. Several types of gram negative rods were found. These have assumed new importance since the use of streptomycin has become practical for they usually are penicillin-resistant but can be inhibited by streptomycin, at least to some degree. Sputum originally containing gram positive organisms may, after the administration of penicillin for several days, contain none or few of these and repeat examination will show almost pure cultures of gram negative (penicillin-resistant) forms. Failure of penicillin to reduce significantly the amount or quantity of sputum is usually a good indication that gram negative or other penicillin-resistant bacteria predominate. The addition of streptomycin in these cases may be gratifying.

We have seen one patient in whom prior to operation thorough administration of penicillin resulted first in a sterile sputum, then in complete absence of any sputum, a fortunate condition which persists to the present time even though a still bronchiectatic right lower lobe remains after resection of a severely diseased left lower lobe and lingula. In most cases, antibiotics can produce temporary amelioration of symptoms with a decrease in amount of sputum which usually also becomes thinner and lighter in color and less malodorous. Unfortunately, however, respiratory infections sooner or later ensue with a flare-up of sputum sometimes amounting to pretreatment measurements. Many such relapses can be treated again with antibiotics. Sulfadiazine, sulfamerazine or any of the associated drugs similarly may produce some temporary benefit. We have never seen a case in which well established bronchographically proved dilatation disappeared on any form of medical therapy although some questionable cases have become definitely normal as far as can be determined without pathologic examination.

Penicillin has been used on 81 in this group and streptomycin on 13 patients. All getting the latter drug also had the former.

In the treatment of these cases of bronchiectasis many methods have been used, not only by us but sometimes by others before

the patients came under our care. Certain of these would be of historical interest only for many measures used at one time have since been abandoned as better ways of handling the problem have been developed. It is our opinion now that only surgical removal of the diseased area can produce a cure. Medical measures, useful as they are, will always fall short of that goal. Therefore, when planning the therapy of these patients we try if at all possible to bring them to surgery. Patients with more than minimal disease or minimal symptoms are advised to have operations unless there is some contraindication. Among these are included old age, poor general condition which would make a surgical procedure unusually hazardous, some severe associated disease such as valvular or coronary heart disease, severe hypertension, nephritis, pulmonary emphysema and so forth, or a disease which in itself takes precedence over the treatment of bronchiectasis, such as psychosis, malignant disease anywhere in the body, brain abscess, severe asthma, active tuberculosis, and so forth. Another contraindication to surgery is disease so widely scattered and severe that its removal would leave insufficient lung tissue to support life. Age in itself is difficult to classify as a contraindication. With increasing experience, the improved skill of surgeons and anesthetists and the use of antibiotics and wholesale blood transfusions, it has been possible in recent years to operate successfully on patients who formerly would have been denied this boon. The age which is considered a contraindication has steadily increased through the years until now we occasionally operate upon patients in their fifties who are otherwise well, and have sent one patient to surgery at the age of 60, with a successful outcome. One patient, aged 63, was operated on transthoracically for diaphragmatic hernia without ill effect and without disturbing the minimal bronchiectasis of the lower lobe. The youngest patient to have lobectomy was seven years old. Chart 1 indicates a rather smooth distribution curve of ages at operation, with the peak lying between 21 and 25 years.

Seventy-eight patients have had 95 operations, removing 126 lobes or segments of lobes. Table 10 indicates the number of times each operation has been performed. Thoracoplasty has been necessary either to close an empyema cavity or a bronchial fistula six times and thoracotomy to drain empyema five times.

In the entire series of cases bronchiectasis has been unilateral 145 times and bilateral 121 times, the remaining cases being questionable. Of the 121 patients with bilateral disease, 25 have been subjected to surgical resection and six of the 25 have had lobectomy or bilobectomy on both sides. In the other 19 bilateral cases surgery on the worse side has allowed so much improvement

that the second operation was deemed unnecessary or some contraindication has arisen.

Disease of the paranasal sinuses plays an important part in the management of bronchiectasis. Conjecture as to whether the sinusitis or the bronchiectasis is the first offender is usually fruitless and always useless. More important is the frequency with which the two diseases are associated and the method of handling the sinus disease when present in conjunction with bronchiectasis. In this series of cases definite sinusitis was proved to be present in 93 persons. Sixty-nine had suppuration while in 24 the membranes were hyperplastic but no pus was present. Undoubtedly, the actual number of patients with diseased sinuses should be higher, this portion of the examination being neglected sometimes for a variety of reasons. Thirty-five patients had radical sinus surgery. The great majority of these had suppurative disease. Several others were advised to have sinus surgery but have either refused or postponed the procedure. Many of the patients not subjected to operations had multiple irrigations or other measures of treatment which produced satisfactory results.

Along with these surgical procedures so-called medical measures of treatment were used, and for the patients in whom surgery was possible, constituted the only form of therapy. General hygienic measures are important. Considerable improvement at times takes place simply by correcting hours of rest, dietary habits and stressing the avoidance of fatigue, respiratory infections, excess tobacco or alcohol. Patients are encouraged to get a long night of rest in bed, daily naps if possible or, in extreme cases, even

TABLE 10

Operations: 78 Patients

Right upper lobectomy	1	
Right middle lobectomy	8	
Right lower lobectomy	9	
Left upper lobectomy	7	
Lingulectomy	1	
Left lower lobectomy	23	
Right upper and middle lobectomy	1	
Right middle and lower lobectomy	5	
Left lower and lingulectomy	21	
Right pneumonectomy	1	
Left pneumonectomy	4	
Drainage of empyema	5	
Thoracoplasty	6	
Multiple segmental removal	2	
Right lower and lingulectomy (situs inversus)	1	
TOTAL		95

complete bed rest for varying periods of time. High protein diets with or without protein supplements often seem to be beneficial, particularly in those with large amounts of purulent sputum. Although no studies of serum protein have been made, it is not at all unlikely that these people lose large amounts of protein in their copious sputum. Vitamin supplements are given for the same reason usually in the form of one of the commercial polyvitamin capsules two or three times daily. Smoking is usually forbidden not because tobacco is of etiologic importance but because inflamed bronchi from any cause are irritated by smoke, with an increase in cough. In fact, several patients with proved bronchiectasis have stopped coughing entirely when smoking was abandoned.

Unless there has been recent severe hemorrhage, severe hypertension, dyspnea or some other contraindication, all patients are encouraged to perform postural drainage faithfully. They are instructed in the proper method as soon as the diagnosis is made and are started on four drainages of 10 minutes daily. If expectoration still occurs between these drainages, the number per day is increased and when the sputum becomes scant or drainages become nonproductive, the number may be reduced. However, all are encouraged to continue this procedure at least once a day. This method of draining purulent secretions is nearly always followed by a decrease in cough and improvement in feeling of well-being which bespeaks its value.

To facilitate the raising of secretions, some form of expectorant is usually prescribed, the one most frequently used being potassium iodide in doses of 10 drops of the saturated solution in water by mouth three times daily. It is a distinct clinical impression that this drug has a mildly antiseptic effect and causes definite thinning of bronchial mucus which in turn seems to soothe inflamed membranes, facilitate expectoration or at times paradoxically to reduce the amount of sputum. The latter phenomenon is perhaps explained by the fact that thinner mucus permits more nearly normal ciliary action in the bronchial mucosa, with resulting less need to expel secretions by cough.

In addition to the above general therapeutic measures two other classes of treatment may be important. These are the antibacterial and antiallergic. One by one as they have been developed and brought out for clinical use, the antibacterial drugs have been tried in bronchiectasis with varying success depending on the drug, the method administered, the bacteria present and the anatomical variations of the disease. There is still a place in certain cases for the sulfonamide drugs given by mouth and nearly all patients with bronchiectasis should have penicillin

unless they have drug sensitivity, and some may be benefited by the addition of streptomycin.

Penicillin is usually given both intramuscularly and by inhalation to hospitalized patients and by inhalation or orally to ambulatory patients. To be effective when inhaled, the drug must be given two to five or more times a day. Solutions containing 25,000 to 50,000 units per cubic centimeter are used and each dose is 1 cc. For ambulatory patients who are working, more frequent inhalations are impractical and perhaps this suboptimal dosage explains the fact that in many patients the aerosols seem less effective than injected penicillin. Recently, finely divided crystalline penicillin has been used as an inhalant, the so-called penicillin "dust" or "smoke."[3] This promises to be a reasonably satisfactory method.

Streptomycin is best given by intramuscular injection, combined if desired with inhalations of nebulized solutions. One half gram four times a day is average dosage for injection and one half gram in divided doses as an aerosol. The use of this drug is usually reserved for patients who do not respond to penicillin and it is customary to institute treatment with the latter drug. If results are not good the sputum is cultured and if organisms that can be expected to respond to streptomycin are found, this agent is added.

Both these antibiotics can be used in several ways. Commonest is to give an initial thorough course of from one to two weeks, then to stop but to resume its use immediately if there is a respiratory infection or any relapse in the amount and purulent nature of the sputum. An alternative method is to use the aerosol once or twice a day as maintenance therapy.

The usual result after the administration of these drugs is that sputum decreases to a fraction of its former amount, loses any unpleasant odor it may have possessed and becomes lighter in color and clearer; in other words, more mucoid and less purulent.

Both penicillin and streptomycin may be used for preoperative preparation and at times sulfadiazine is added. Four to seven days of antibiotic therapy preoperatively are usually amply rewarded by a marked decrease in postoperative morbidity and complications so that total hospitalization is actually less than if the preoperative treatment is omitted.

At times it has been necessary to discontinue penicillin aerosol because of the development of inflammation of the buccal mucosa and tongue, while an occasional patient develops urticaria or other forms of dermatitis from intramuscular penicillin. The use of one of the antihistamine drugs may permit continuing the antibiotic even in the presence of this allergy. However, we recently had

one patient being prepared for surgery who developed such a severe pruritic generalized vesicular eruption that penicillin had to be permanently abandoned. He was successfully carried through his operation and the postoperative period on streptomycin alone and developed no pleural infection.

Allergic individuals usually react excessively to infection and are prone to have severe and stubborn symptoms when afflicted by bronchiectasis or sinusitis. More than once symptoms have been seen to persist in a patient otherwise thoroughly treated until a full allergy regimen is instituted. Therefore, signs or hints of allergy should be carefully sought in all bronchiectatic patients, but particularly in those doing poorly. The history may show strong allergic tendencies in patient or family or he may have such signs as urticaria, atopic dermatoses, hay fever, wheezing, pale boggy nasal mucous membranes, hyperplastic sinusitis, and so forth. Clinical evaluation, including intradermal tests, may indicate elimination regimens or hyposensitization therapy which will make the difference between success and failure. Patients with severe asthma and mild bronchiectasis may do well on anti-allergic measures alone without the necessity for antibiotic drugs or surgery. Vaccines, either autogenous or of the common respiratory organisms, are likely to cause improvement, particularly in the patient with an allergic background.

Finally should be mentioned the beneficial effect of change of climate on certain persons. Cold, damp and changeable climates are conducive to respiratory infections. On the other hand, in dry, warm, equable climates acute respiratory diseases are less common so the patient living in these areas is less exposed to infection. There is nothing about any climate which will cure bronchiectasis but some people who cannot have surgery and who are economically able to make the change live longer and more comfortably in a climate such as that in the southwestern part of the United States.

The evaluation of results of treatment in this disease is in large part dependent upon the patient's opinion, so it is difficult or impossible to be strictly objective. We have arbitrarily placed each patient in one of seven categories. "No result" or "unchanged" is obvious. "Worse" indicates the patient to be in poor condition or having more symptoms than before therapy. Patients who died during or as a result of treatment are in this category although patients who died some months or years after treatment was begun are judged on their condition when last seen. Plus 5 is reserved for those patients who are completely cured, free from all symptoms and not handicapped or restricted in any activity. Plus 4 indicates patients free from demonstrable bronchiectasis

but who may have minor symptoms not directly related to bronchiectasis or minor restriction of activity after treatment. Plus 1, 2 and 3 indicate varying degrees of improvement from slight to moderately great, with or without any restriction of activity.

One hundred ninety-four patients were treated and followed long enough to evaluate the results (Table 11). Length of follow-up ranged from one month to 12 years; 108 of them were followed in excess of 10 months, while only 40 were followed less than four months.

The results of treatment in all patients is shown compared to the results in all surgically treated cases and in those with bilateral disease on whom a surgical procedure was carried out. It is worthy of note that all cases classified plus 5 had surgery and in general the better results were produced in those patients undergoing operation.

One surgical patient was not followed postoperatively, one has just been operated on and there is no opportunity yet to evaluate

TABLE 11

194 Cases Followed One Month to Twelve Years

Rate of Improvement	All Cases	Surgical Cases	Bilateral Surgical Cases
0	37	2	2
+1	39	1	1
+2	34	10	7
+3	36	21	8
+4	30	27	5
+5	11	11	1
Worse	7	3	1

TABLE 12

Results When Penicillin and Streptomycin Are Used

Rate of Improvement	All Cases	Surgical Cases	Nonsurgical Cases
0	6	2	4
+1	16	3	13
+2	15	9	6
+3	15	10	5
+4	17	16	1
+5	5	5	0
Worse	3	1	2

results. Of the 3 classified as worse after operation, one described above developed advancing tuberculosis and eventually died about two years after lobectomy and one died suddenly on the second postoperative day and is the only operative mortality. The other patient developed postlobectomy empyema, eventually required a thoracoplasty and finally when last heard from had had recurrence of cough and sputum. In general, the surgical cases fall into the groups of better results while the nonoperated cases are evenly distributed through the less favorable classifications.

Table 12 shows the results when penicillin was used. Except for the fact that there were relatively few patients who had no improvement after using penicillin, no remarkable increase in the number of good results was apparent. The addition of surgery to the treatment, however, causes a marked increase in the number of good results when compared to those treated with penicillin but without resection.

The most difficult cases to treat are those who have severe bilateral disease. It has already been indicated that in unilateral cases we favor surgery if at all possible. When portions of both lungs are involved this becomes at times a matter for keen judgment. Such patients are given full medical treatment and sinus surgery if indicated. An effort is then made to evaluate a complete bronchogram, showing all lobes, and to judge as accurately as possible how much undiseased lung is present, whether the diseased lobes are being used at all for oxygen exchange and what percentage of the disease is in each lung. We have found that if as much as 70 per cent of the bilateral disease is in one lung, removing that portion may permit sufficient improvement that resection of the remaining disease may be unnecessary. Medical treatment, then, after the major portion of the infected focus is removed, may reduce cough or sputum to a tolerable minimum. This is accomplished partially because of the improved general resistance and partially because the better lung is no longer bathed by purulent secretions spilled in from the other side.

After such unilateral surgery on bilateral disease, the patient is followed carefully and six months to a year later roentgenograms and bronchograms are done to re-evaluate the problem. Then, if symptoms warrant and sufficient vital capacity remains, an operation on the other side can be done. In patients with bilaterally equal disease bilateral surgery is planned from the first but is still done in two stages, with six months to a year between and re-evaluation before the second operation. In suitable cases both lower lobes, the right middle lobe and the lingula can be removed with enough vital capacity remaining in the upper lobes to permit practically normal life.

It has been our experience that when one side of the chest is opened all the disease on that side must be eliminated. If even mildly bronchiectatic segments are allowed to remain they sooner or later become worse, no doubt in part at least due to the mechanical dilatation caused by overexpansion to fill the thoracic cavity. Then symptoms recur and secondary operations become necessary. The decision of how much lung to remove should be made prior to operation. The reason is amply illustrated by a case in which there was some discussion as to whether the lingula was diseased. At operation the surgeon could find no gross evidence of disease in this segment so only the obviously abnormal lower lobe was removed. A recurrence of symptoms prompted a review of the bronchogram which showed that the lingula was in fact dilated, and a secondary operation became necessary.

The postoperative course of patients having the first stage of bilateral operations is seldom as smooth as when all the disease can be eliminated at once. Collection of pleural fluid, difficulty in expanding the remaining lobe, excess bronchial secretions which are difficult to raise and may cause atelectasis are all frequently encountered and require diligence and speed to discover and treat promptly. A smooth and uncomplicated postoperative course is of more than minor importance because patients with complications, even though they eventually get well, frequently have thickened pleuras and reductions in pulmonary elasticity and

FIGURE 3

FIGURE 4

Fig. 3: Bronchogram showing a bronchiectatic segment in each lobe, later removed by multiple segmental resections.—*Fig. 4:* Bronchogram showing localized bronchiectasis in right lower lobe caused by aspiration of a head of timothy grass.

chest wall or diaphragmatic movement which markedly reduce vital capacity and may be more of a handicap than would the sacrifice of a small segment of lung. For these reasons it is often wiser to perform total lobectomy rather than to attempt to save an undiseased segment. Segmental resections, good as they may be theoretically, are usually followed by more postoperative difficulties than are lobectomies. If the disease is widespread and bilateral, as much lung as possible must be conserved so that possible dangers of postoperative complications must be carefully weighed against the amount of lung to be sacrificed before making the important decision as to whether to do a segmental or total lobectomy. A man, aged 30, with multiple bronchiectatic segments in each lung illustrates perfectly the excellent result which may follow multiple segmental resections (Fig. 3). On the other hand, one or two other patients have ended by losing an entire lung because of an attempt to save a segment not diseased at the time.

When pulmonary resection is being considered, the question frequently is asked as to whether if one lobe is removed the disease will develop in another lobe. This occurrence is distinctly uncommon unless there is an intervening acute episode of some type to act as a new etiologic factor. We have seen this occur in a patient who had not had a surgical procedure but who had severe disease in one lobe and mild disease in another as proved bronchographically. After two episodes of pneumonia the symptoms became worse and restudy with lipiodol showed the first lobe as before, the second severely involved and a third and previously normal lobe definitely bronchiectatic. In the several examples seen in which symptoms reappeared after surgery, a review of the bronchograms done preoperatively has always shown either disease previously present and not removed or an inadequate demonstration of the lobes not resected. It is for this reason that we now insist on thorough demonstration of all pulmonary segments preoperatively, at least on the side to be attacked.

Several special types of bronchiectasis deserve some mention. The inhalation of a foreign body is an occasional cause for bronchiectasis. Obtaining a history of such inhalation is often difficult for the memory of such an event may be clouded by many years of intervening symptoms. One patient in this series was discovered at operation to have a chicken bone lodged in the bronchus and only after this was revealed to him could he remember the event 17 years before when he choked. Foreign bodies may be completely nonopaque to the roentgenograms so the fact alone that nothing suggestive is visualized need not rule out this situation. One patient was found at surgery to have a head of timothy grass in a segmental bronchus in the right lower lobe. It had been inhaled

two years before and when postoperative pneumonia developed after appendectomy two weeks later, the persistent cough and sputum were assigned to that cause until a careful history suggested the possibility of the presence of a foreign body and lobectomy revealed the foreign material still *in situ* (Fig. 4). That this may not be too uncommon is suggested by a recent report of 8 cases with this etiology.[4]

Anything which obstructs, stenoses or interferes with bronchial drainage may instigate bronchiectasis. Congenital defects in bronchial distribution usually fall into this category and predispose to infection. Several such cases have been included in this series. Benign tumors such as bronchial adenomas have twice been a cause of dilated bronchi behind the obstructed area (Figs. 5 and 6). A not uncommon cause for bronchiectasis limited to the middle lobe is stenosis caused by pressure on the bronchus from an enlarged lymph node. Although this may be an acute inflammatory node, even more common is a calcified tuberculous node which seems particularly prone to affect this bronchus. In eroding through the bronchial wall, it institutes the syndrome of middle lobe atelectasis and bronchiectasis (Figs. 7 and 8).

Tuberculosis not infrequently involves the bronchial wall by direct extension. This may result in kinking or narrowing during the course of healing which, combined with fibrosis and contraction of the pulmonary parenchyma, also causes bronchial dilatation. When secondary infection is superimposed, it is difficult to distinguish this "tuberculous bronchiectasis" from the more common variety except that the former is more prone to occur in the upper lobes.

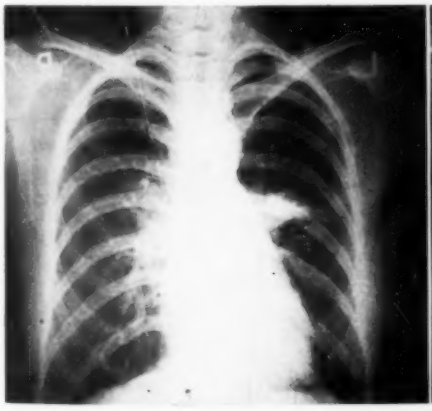

FIGURE 5

FIGURE 6

Fig. 5: Roentgenogram showing small benign adenoma in left upper lobe with segmental area of atelectasis and bronchiectasis distal to it.—*Fig. 6:* Bronchogram demonstrating bronchiectasis in right lower lobe proved at lobectomy to be due to a bronchial adenoma.

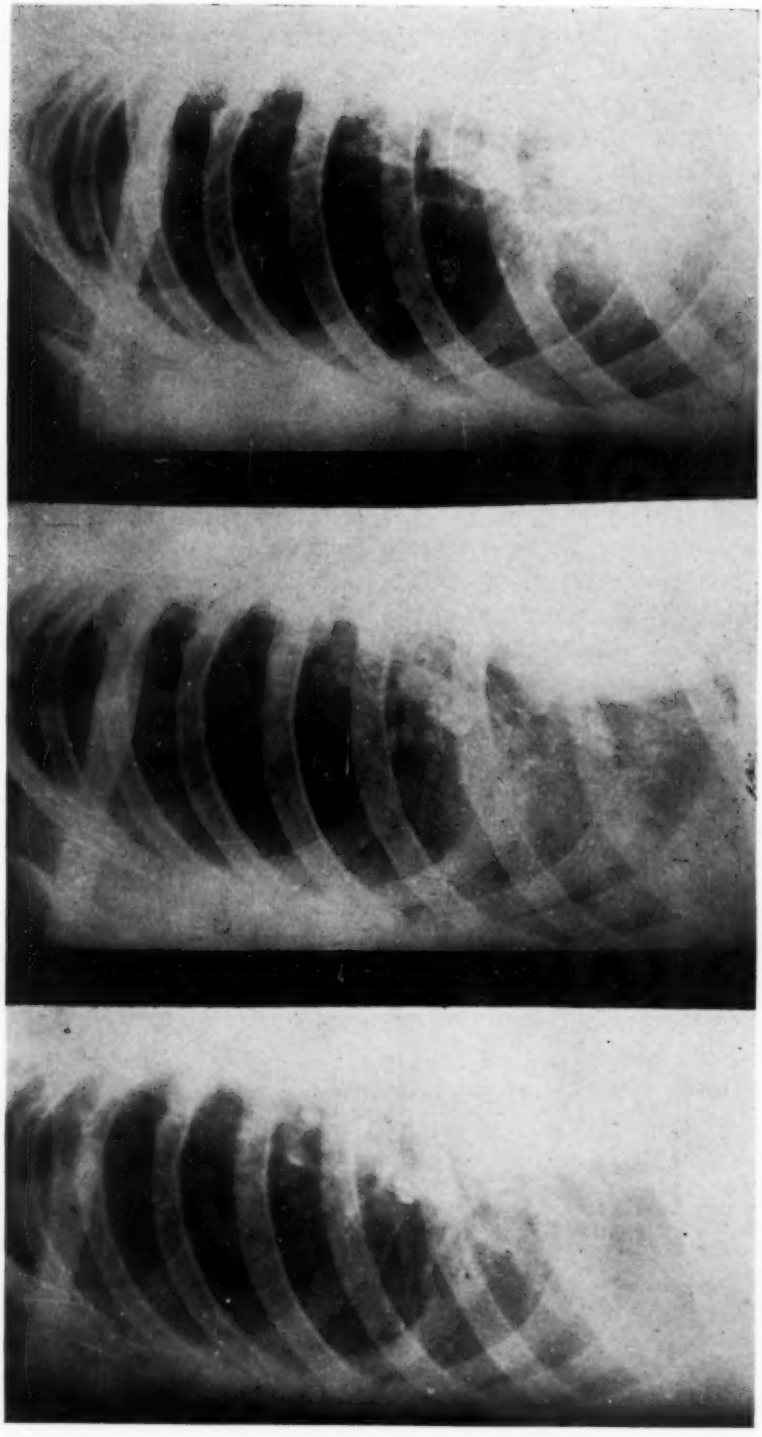

FIGURE 7: Calcified lymph node near right middle lobe bronchus in 1939 film (left). Area of pneumonitis and atelectasis beyond node in 1944 (middle). Broncholith has been coughed out leaving collapsed middle lobe in 1946 (right).

Much confusion still exists as to the relationship of congenital cystic disease to acquired cystic bronchiectasis. This is of little importance as the two are indistinguishable when fully developed. It is more important to realize that early in the disease before great thickening of the bronchial or cyst walls takes place the roentgenograms may show little or nothing abnormal. Only bronchography can confirm the diagnosis in these cases and again all lobes must be filled to avoid missing some of the disease (Fig. 9).

Not all cases are accompanied by great amounts of sputum. Some are completely or almost completely "dry." In these cases the bronchi are dilated with relatively little thickening of their walls. Plain roentgenograms are often negative or inconclusive. Hemoptysis may be the only symptom calling attention to the condition. Sometimes only careful search with thorough bronchography will reveal the minimal dilatation in one small bronchial segment which is the source of bleeding.

Diseased segments of lobes are not too uncommon. Occasionally, scattered segments in several lobes are seen with the remainder of the bronchi being normal. One case, previously mentioned, had a diseased segment in every lobe. This problem was handled surgically in two stages by multiple segmental resections with excellent results.

The incidence and method of treatment of sinusitis have been

FIGURE 8

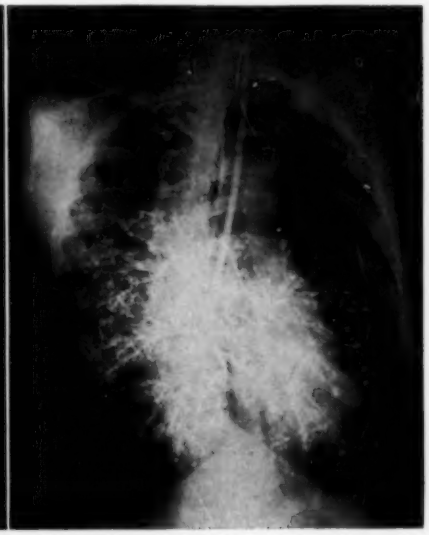

FIGURE 9

Fig. 8: Atelectatic middle lobe containing saccular dilatations of the bronchi not well shown in the reproduction.—*Fig. 9:* Right anterior oblique view to show particularly the bronchogram of left lung which contains cystic bronchiectasis in upper lobe, including lingula and lower lobe. No evidence of disease in upper lobe was seen on plain roentgenogram.

noted. Good results cannot be expected by treating the sinuses alone but neither will success follow the treatment of bronchiectasis, no matter how thorough, if the sinusitis is neglected. If suppurative sinusitis is present it should be treated by whatever method is necessary, preferably before pulmonary resection is done. Both the incidence of postoperative morbidity and recurring bronchial symptoms after eradication of the bronchiectasis will be reduced by this precaution.

There is little correlation between the amount of sputum or severity of symptoms and the extent of disease as demonstrated roentgenographically. Many patients with huge sacculations seem to have few symptoms and little toxicity. On the other hand, an occasional patient has a great deal of diffuse bronchitis which causes much cough and sputum, yet bronchial dilatation is minimal. These patients often respond well to medical treatment.

The importance of vital capacity has been hinted. Most patients with capacities below 1500 cc. are poor risks for surgery. However, if the diseased lobe is atelectatic it contributes little or not at all to respiratory function and its removal may cause little or no further reduction and the resulting freedom from cough and toxicity more than makes up the difference. The removal of a non-atelectatic lung reduces the vital capacity by about one half. Some remarkable improvements in vital capacity have taken place on treatment. One woman with a vital capacity of only 800 cc. was turned down for surgery. Thorough treatment with penicillin and other medical methods has caused an increase in capacity to 1800 cc. and the possibility of lobectomy on the worse side is now being considered. Another patient had complete atelectasis of one lung with bronchostenosis and multiple bronchiectatic cavities. Her disease was of lifelong duration and the vital capacity only 700 cc. Medical treatment preoperatively brought it up to 1000 cc. and after pneumonectomy it is now 1400 cc. and she feels infinitely better. In this case her vital capacity was doubled by removing one lung. The answer to this seeming paradox probably is that the drowned lung preoperatively acted as a mechanical drag, preventing good expansion of the other lung, and the good lung was also constantly handicapped by being filled with pus from the infected side.

Resected lungs or lobes almost invariably appear more diseased than would have been suspected by examining the patient, his roentgenograms or his bronchograms. For this reason even minimal disease, if localized, is usually worthy of surgical removal. These diseased areas are of relatively little use in oxygen exchange and constitute a constant hazard to future health. Little stress has been placed on bronchiectasis as a focus of infection which

has a detrimental effect on other parts of the body. One of the patients in this series had a metastatic brain abscess from the diseased bronchi. Others have had arthritis apparently secondary to the disease, and several women with depressed ovarian function manifested by amenorrhea or infertility have responded after resection of the bronchiectatic lobe by resuming the menses or becoming pregnant. Frequent colds may be caused by bronchiectasis, whether owing to general reduction in immunity or localized lack of resistance in the respiratory tract.

In accord with good surgical principles, diseased areas must be totally removed if operated on at all, and surgery short of resection is always inadequate. Many years ago attempts were made to handle this problem by thoracoplasty, phrenic neurectomy or thoracotomy and freeing up the diseased lobe without resection. With few exceptions, these efforts were worse than useless and with the present state of development of thoracic surgery, are not to be condoned.

Throughout the entire period of this study evidence has accumulated that within the well recognized pattern of the disease numerous variations occur which make of each case a problem in itself. To achieve the best results in bronchiectasis it is necessary to realize that, aside from the patients who can be cured by radical resection of all the disease, improvement depends on a long term management of the many factors which contribute to each case. In this regard the intelligence, economic status and cooperation of the victim of the disease are as important as the doctor's interest, persistence, attention to detail and ingenuity.

SUMMARY AND CONCLUSIONS

Two hundred and seventy-seven cases of bronchiectasis observed by one individual have been reviewed. The chief complaint of half the patients was cough. Hemoptysis occurred at some time during the observation in over half the patients, and was the presenting symptoms of 33. Pneumonia had been present at some time in 159 cases. Plain roentgenograms were abnormal in 251 patients but in 20 were entirely normal.

A great variety of microorganisms occurred in the 93 sputa cultured, but either penicillin or streptomycin had a marked effect in altering the amount and characteristics of the sputum.

The methods of treatment have been discussed, with their indications and contraindications. Since surgical extirpation of the diseased area is the only method of cure this is advised unless contraindicated. The types of operations in the 78 patients handled by this means have been listed.

Medical measures of handling bronchiectasis have been described,

including a discussion of penicillin. The results have been classified in the 194 patients treated and followed from one month to 12 years. The most favorable outcome is obtained in those handled surgically, although some improvement occurred in most patients treated.

The method of handling bilateral cases surgically has been discussed in detail and these results compared to the general run of cases treated medically and surgically.

Unless it is possible to obtain a radical cure by surgery, bronchiectasis must be managed by a complete program carefully followed by the patient in full cooperation with an interested physician.

SUMARIO Y CONCLUSIONES

Se revisan 277 casos de bronquiectasis observados por una persona. El síntoma principal de la mitad de los enfermos fué la tos. La hemoptisis se observó alguna vez durante la observación en más de la mitad de los casos y fué la causa de ver al médico en 33 casos.

Se observó neumonía alguna vez en 159 casos.

Las radiografías simples fueron anormales en 251 enfermos, pero en 20 eran enteramente normales.

Una gran variedad de gérmenes en los esputos pudo observarse en los 93 esputos cultivados, pero ya sea la penicilina o la estreptomicina tuvieron gran influencia alterando la cantidad y características de ellos.

Se discuten los diversos tratamientos y sus indicaciones y contraindicaciones. Puesto que la extirpación quirúrgica es el único procedimiento curativo, se aconseja se adopte a menos que haya contraindicaciones. Los tipos de operaciones usados en 78 enfermos se indican.

Los procedimientos médicos empleados se describen incluyendo una discusión sobre la penicilina. Los resultados obtenidos en 194 enfermos tratados y vigilados durante un mes a doce meses se presentan clasificados. El resultado más favorable es el obtenido por los procedimientos quirúrgicos si bien todos los tratados mejoraron en general.

El procedimiento para tratar los casos bilaterales es motivo de comentario en detalle y sus resultados son comparados con la evolución general de los tratados quirúrgicamente y por procedimientos médicos.

A menos que sea posible obtener una curación radical por la cirugía, la bronquiectasis debe considerarse en su terapéutica bajo un programa completo que debe ser seguido completamente por el enfermo cooperando con el médico interesado.

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A Method for Topical Anesthesia by Nebulization of Local Anesthetics†

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The number of procedures involving the direct examination of, and the introduction of instruments and materials into, the tubular structures of the respiratory tract is increasing. This increase in endoscopic procedures has been attended by greater efforts to overcome the natural defenses of the entrance to the respiratory passages. The defenses are:[1]

1) The swallowing reflex, originating chiefly in the posterior pharynx, dorsum of the tongue, and pyriform sinuses.

2) The gag reflex, originating chiefly in the anterior faucial pillars, soft palate, uvula, epiglottis, and posterior pharynx.

3) The cough reflex, originating chiefly in the larynx, trachea, and carina.

4) The anatomic position and structure of the larynx, at right angles with the oral cavity, below the epiglottis, and with the strongly contractile glottis at its entrance.

5) The patient's general apprehension concerning instrumentation of the respiratory passages.

The most commonly practiced method of reducing the patient's apprehension is by preliminary sedation and a brief explanation of the necessity for relaxation and cooperation. The reflex defenses are usually attacked by administering a surface anesthetic. The anatomic peculiarities of the larynx constitute a major difficulty in introducing anesthetic solutions as well as instruments and other materials.

The conventional technique of obtaining surface anesthesia consists of "boldly squirting 2 or 3 cubic centimeters from a syringe (or atomizer) through the mouth on to the posterior pharyngeal wall; after which the anesthetist side-steps smartly out of the line of the patient's mouth and relies on the violent gagging and coughing to spread the liquid throughout the pharynx and larynx."[2] It is usually necessary, in addition, to swab the

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anterior pillars and pyriform sinuses with cotton pledgets soaked in the anesthetic solution, and finally to inject more of the solution into the larynx through a curved tracheal cannula under laryngoscopy. The anesthesia which results is often inadequate for bronchoscopy, necessitating the application of additional solution directly onto the carina through the bronchoscope.

The disadvantages of this technique are apparent. It requires an excessive quantity of the drug, several specialized instruments, and a technically skilled operator. It is distasteful to the patient and time-consuming to the physician. Consequently there has been a concerted attempt to develop a technique which secures adequate and widespread anesthesia without these disadvantages.

Perhaps the most precise modification of the conventional method is that described for laryngoscopy by Jackson,[3] who atomizes the pharynx and right faucial pillar for one or two seconds with 10 per cent cocaine. He then introduces three or four drops of the solution into the larynx under mirror visualization, and after 3 minutes repeats this amount. Jackson states that it is essential that every drop from the syringe be seen to enter the larynx in order to obtain adequate anesthesia from such a small amount of solution. For bronchoscopy, he mentions the additional application of a small quantity of 4 per cent cocaine through the bronchoscope. While the amount of solution employed in his procedure is small, all the other disadvantages are still present. The accurate placement of each drop of solution depends on a dexterity that few operators possess.

Another modification using small dosage has been described recently by Carabelli[4] who employs 0.25 per cent pontocaine. He uses a total of 8 cc. of solution, first spraying into the pharynx through a micro-atomizer, then instilling the balance into the trachea through an endotracheal catheter. Its chief advantage is that it is one of the few techniques in the literature that does not exceed the recommended dose of the drug. Its main disadvantage is that it involves introducing an endotracheal catheter. Furthermore, our work with fine particle atomizers disclosed that the disadvantages inherent in the use of ordinary atomizers were not completely overcome.

The disadvantages encountered in spraying via the mouth led to an investigation of the nasal route. Adams,[5] Slater,[6] and Carr and his associates,[7] have described techniques of instilling the anesthetic solution through a nostril while the tongue is held to prevent swallowing. When the solution reaches the glottis, coughing occurs; continued administration followed by further coughing finally results in anesthesia which is adequate for injecting iodized oil through the same nostril for passive bronchography. The use

of this technique reduces but does not eliminate the patient's discomfort; it may be used for bronchography, but is not applicable to endoscopic procedures.

A technique described by MacIntosh[2] utilizes a rubber nasal catheter with an atomizer tip. The catheter is used to direct the atomized cocaine into the nasal and pharyngeal passages, being gradually advanced through the nasopharynx as anesthesia is obtained, and finally passed into the larynx for endotracheal anesthetization. He states that a cough is a sure sign that the spray has found its target. Thus the technique involves discomfort to the patient, and requires skillful manipulation to pass the catheter into the larynx. Rowbotham,[8] Kenton,[9] and Harang[10] have each designed different instruments or procedures which are subject to the same disadvantages as those described.

Still another route of administration has been employed by Armand-Delille,[11] Guy and Elder,[12] and Grady.[13] They insert a cannula through the skin of the neck and the cricothyroid membrane directly into the larynx after local infiltration of these tissues with 0.5 per cent procaine. A topical anesthetic is then injected through the cannula, producing a paroxysm of coughing which serves to spread the agent throughout the area to be anesthetized. Iodized oil may then be injected through the same cannula to obtain bronchograms. This has been described as an excellent technique for bronchography in small children, but seems somewhat radical in approach with potentially grave complications.

The technique designed and originally described by us[14] is based on nebulization of the surface anesthetic solution. By having the patient inhale the mist under certain conditions, a profound surface anesthesia is obtained which extends from the external nares and mouth to the finest bronchioles. Other authors[2,15,16] have noted the logic of the use of nebulizers in obtaining surface anesthesia, but have not described a detailed technique or a tabulation of results.

It is important to distinguish nebulization from atomization. Ordinary atomization is the production of a spray of relatively large droplets travelling at high speed. When this spray strikes the sensitive areas of the pharynx which must be reached to obtain adequate anesthesia, it usually results in gagging, retching, and coughing, as previously pointed out. In nebulization the largest droplets are baffled out within the nebulizer, resulting in a fine mist of particles that may be inhaled comfortably and carried by convection into the deeper bronchial passages.[17] This method overcomes all the defenses of the respiratory system, without the disadvantages of the conventional method of anesthesia or its modifications.

Materials

The essential instrument is an adequate nebulizer. We have found some nebulizers to be inadequate. The following properties of the nebulizer are desirable:

1) Efficiency of nebulization: The delivery of aerosol by the nebulizer must be sufficiently rapid. Many nebulizers are inefficient, i.e., the amount of liquid delivered per unit volume of gas passing through the nebulizer is low, and adequate anesthesia is difficult to establish.

2) Construction of the nebulizer: The well of the nebulizer must be capacious enough to accomodate 8 cubic centimeters of solution. It must also be so constructed that tilting the nebulizer *does not easily spill the solution out of the neck of the nebulizer into the patient's mouth,* since rapid absorption of surface anesthetics may result in toxic reactions.

3) Particle size distribution: The aerosol produced by the nebulizer must consist of particles which are below the size range that produces reflex gagging, and yet not so small that they remain suspended and are exhaled (approximately 0.5 micron and smaller). The ideal particle size range for surface anesthesia is 0.5 to possibly 5 micron in radius. Within this range, the majority of particles should be small enough (0.5 to 2 micron) to be carried by convection and deposited in the bronchial tree. A substantial amount of the aerosol, however, should consist of intermediate sized particles (2 to 5 micron) that will be deposited by centrifugal force in the pharynx and larynx.

Some nebulizers produce too high a percentage of larger droplets that are unable to traverse the pharyngo-laryngeal angle without deposition on the posterior pharynx, and hence fail adequately to anesthetize the bronchial tree. These nebulizers are little better than atomizers in their final results. Other nebulizers produce an aerosol consisting almost entirely of particles so small that they uniformly reach the bronchial tree, but fail to anesthetize the pharynx and larynx adequately through lack of sufficient particles of intermediate size.

This phenomenon has been studied exhaustively by nebulizing known quantities of PSP from various nebulizers, to the delivery ends of which are attached right-angle L tubes. The amount of PSP remaining in the nebulizer and the amount deposited in the L tube after nebulizing under uniform conditions can be determined colorimetrically. From these figures can be calculated the per cent delivery of the nebulizer and the per cent deposition of intermediate sized particles in the L tube.[18,19]

A nebulizer that fulfills the requirements for use in surface

anesthesia, both clinically and in laboratory studies of particle size distribution is the De Vilbiss No. 40. Intermediate sized particles comprise 15 to 20 per cent of the total delivery. This model was used for all cases herein reported.

Oxygen or air may be used to nebulize the solution. An oxygen tank with attached flow meter, or an air compressor will suffice. Oxygen was used routinely for these cases because of its availability and convenience. The pressure was transmitted to the nebulizer through ordinary gum rubber tubing.

A simple mouthpiece for the nebulizer consists of a segment of rubber tubing three inches long and one-half inch in diameter (Fig. 1). It is pushed about one inch onto the oral end of the nebulizer so that the point of delivery of the aerosol is extended about two inches into the mouth. This is an important step in procedure as it prevents the patient from unwittingly baffling out much of the aerosol by partially occluding the mouth of the nebulizer with the teeth or tip of the tongue.

In performance of bronchography, lipiodol is often instilled through the nose and allowed to flow passively into the bronchial tree. In such cases, nasal tips* may be attached to the

*The nasal tips and the nebulizer are included in the De Vilbiss No. 640 combination.

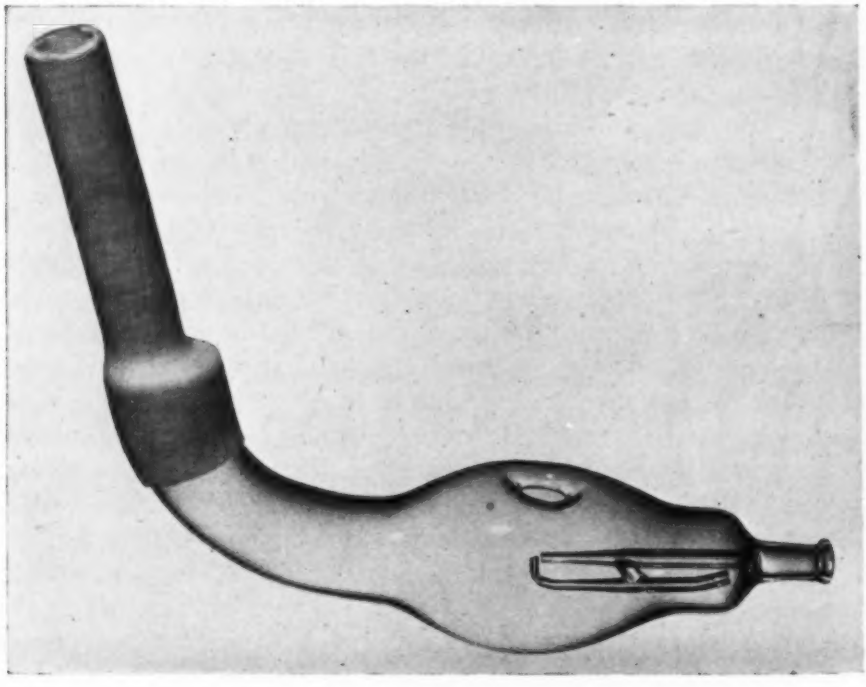

FIGURE 1: DeVilbiss No. 40 nebulizer with rubber mouthpiece.

nebulizer and the first half of the anesthetic solution inhaled through the nose to insure anesthesia of the nasal and nasopharyngeal mucosa.

The anesthetic solutions preferred are 0.5 per cent pontocaine and 4 per cent cocaine. After extensive experimentation it was found that stronger solutions were unnecessary, and weaker ones inadequate. One minim of epinephrine 1:1000 is added for each cubic centimeter of solution to delay absorption. When cyclopropane anesthesia is to follow, the epinephrine is omitted to prevent a possible cumulative irritation of the cardiac musculature.

The only other materials employed are those necessary for maintaining proper precautions whenever surface anesthetics are used, viz. sodium pentothal, epinephrine, a suction machine, and apparatus for administering oxygen and artificial respiration.

Premedication

Our patients are usually premedicated with nembutal two hours before, and morphine and atropine one hour before anesthetization. The dosage may be varied to suit the individual patient or the preference of the physician, and substitutions such as demerol, codeine, scopolamine, etc., are perfectly compatible with good results. However, either atropine or scopolamine should always be employed, as copious secretions tend to dilute the anesthetic agent, and the concentration of these agents is already minimal. The premedication serves the purpose of sedating the patient, minimizing apprehension, inhibiting secretions, and combating the side reactions of the anesthetic agent.

Method

The patient is seated, his nose is occluded by adhesive tape, and he is instructed to relax and simply breathe through his mouth. Eight cubic centimeters of anesthetic solution are introduced into the nebulizer and the oxygen flowmeter adjusted to approximately 6 to 8 liters per minute for continuous nebulization. Generation of aerosol continuously is more wasteful than generation only during inspiration, but it allows the use of a single technique on patients of all ages and degrees of ability manually to operate a Y tube.

The production of aerosol is demonstrated to the patient, and it is explained that he is to inhale the mist. The nebulizer is inserted into the patient's mouth in such a way that the delivery end of the rubber mouthpiece is well into the back of the mouth. As the patient is inhaling the aerosol, he is prepared for the sensations of surface anesthesia by explaining that soon his tongue will become numb, he will feel a "lump" in his throat, and he

will finally be unable to swallow. He is then instructed in the proper method of holding the nebulizer and he continues to do so for 30 minutes.

During the first five minutes the tip is allowed to point straight back toward the uvula. Then the anterior faucial pillars are anesthetized by turning the nebulizer 30 degrees for five minutes to each side in turn. For the second 15 minute period, the patient holds his own tongue forward with a gauze sponge, introduces the nebulizer tip as far back as possible, and aims toward the larynx and the pyriform sinuses for five minutes each. The entire procedure requires 30 minutes. In this way, the aerosol reaches not only the deeper bronchial structures by convection, but also the sensitive areas of the pharynx and larynx by direct impact. After the preliminary instruction, the patient continues his own anesthetization without fear or apprehension, and immediately at the end of nebulization is ready for the endotracheal or endobronchial procedure. The entire technique requires about five minutes of the anesthetist's time. The anesthetist therefore, is free to do other work in the 25 minutes remaining while the patient administers his own anesthetic under supervision.

Modifications of Technique

1) For recumbent patients: Our experience with surgical patients has been predominantly with cases requiring endotracheal intubation for the administration of general anesthetics. It is generally agreed[2] that topical anesthesia is preferable or is a

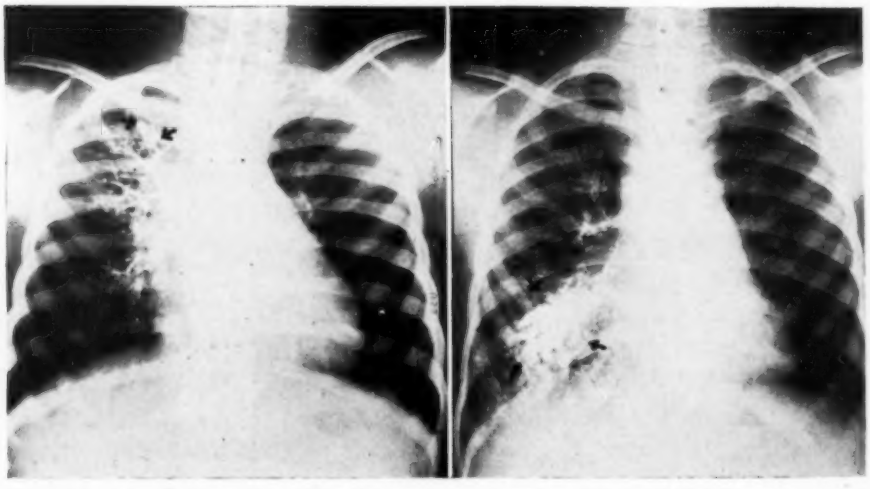

FIGURE 2A FIGURE 2B

Fig. 2A: Bronchogram of a 5 year old child with bronchiectasis of the right upper lobe.—*Fig. 2B:* Bronchogram of a 10 year old child with bronchiectasis of the right middle lobe.

desirable supplement to general anesthesia for the introduction of the endotracheal tube. Since the patients are routinely wheeled into the hall or foyer of the operating room on stretchers to await their turn on the operating table, a convenient place and time for administration are available. The nose is taped off and the patient's head rotated to one side and the mouthpiece introduced by an assistant as described above. Because of the sedation and reclining posture, the patients often doze throughout the procedure.

2) For small children: Children above the age of four or five years use the same techniques as described for adults. For younger children, the entire procedure is carried out with the child sitting on the lap of a nurse, who cuddles the child in one arm and places the straight rubber tip of the nebulizer in the child's mouth as though administering a bottle feeding. The younger child has a feeling of security when handled in this way, and the elements of fear and apprehension are almost completely absent. The use of nebulization anesthesia was originally conceived for the purpose of obtaining bronchograms in children with chronic pulmonary diseases and our experiences with this method have been gratifying (Fig. 2).

Results

The procedures performed with this technique include bronchography, bronchoscopy, bronchospirometry and endotracheal intubation. In order to have all participating physicians evaluate cases uniformly, four degrees of response were formulated. An excellent

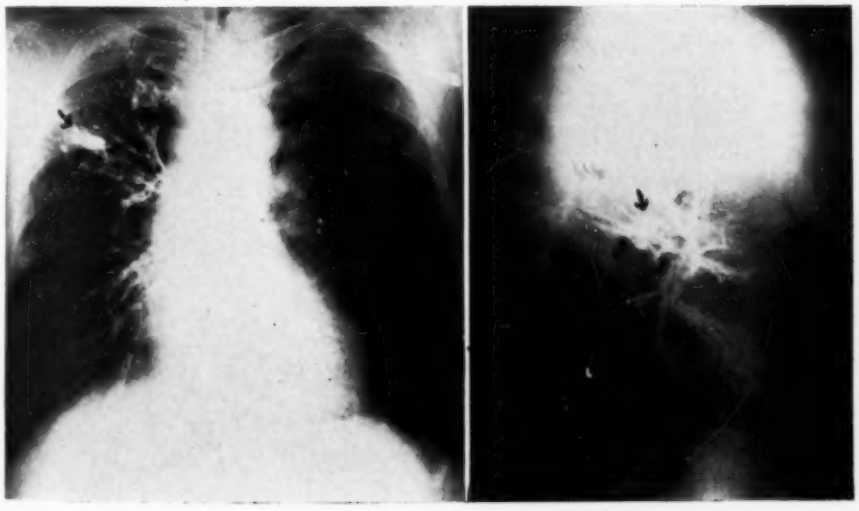

FIGURE 2C FIGURE 2D

Bronchograms of an adult, demonstrating the entire bronchial tree, with filling of what is probably an epithelialized tuberculous cavity.

result was considered one in which there was absolutely no gag or cough during the entire endotracheal or endobronchial procedure, a condition that is infrequently obtained by conventional methods. For bronchoscopy this classification had to be slightly modified as it was observed that an occasional patient emitted a single mild coughing effort when the bronchoscope reached the carina. A good result was one in which there was slight gagging or coughing which immediately subsided and did not interfere with the endoscopic procedure. A fair result was defined as one in which there was occasional repeated gagging or coughing. A poor result was one in which marked gagging and coughing occurred throughout the procedure. The vast majority of results fell into the classification of excellent, and the balance were good. There were no fair or poor results recorded by any of the operators, when using the technique exactly as described.

This is apparently the simplest technique devised for obtaining surface anesthesia of the entire respiratory passage. It requires no operative skill or manipulative ability, and no expensive or specialized instruments. All the materials are standard hospital equipment except the nebulizer, which is available at almost any pharmacy. A profound and evenly distributed anesthesia is obtained throughout the lower as well as the upper respiratory tract with no discomfort to the patient. The anesthesia is always as good as that obtained by conventional methods and in most cases better.

The time required of the anesthetist is less than in other methods, as the patient administers the greater part of the anesthetic to himself. Even when the patient is necessarily recumbent, the modified technique allows the anesthetist to circulate in the close vicinity of the patient while an assistant trained in the signs of toxicity holds the nebulizer and stands watch by the stretcher.

Aside from the medical and technical aspects, one of the greatest advantages is the absence of discomfort to the patient. There is no gagging, coughing, or spitting associated with its use. Finally the likelihood of toxic reactions is greatly diminished. The retention of various aerosols administered in the manner described has been reported by several authors to be of the order of 6 per cent,[20] 15 per cent[21,22] and 25 per cent.[23] In attempting to evaluate per cent retention of aerosols when administered as described, one of us (J.B.M.) inhaled a solution of phenolsulphonthalein, using the method of Abramson, and found that the total urinary excretion was 14.57 per cent after 16 hours. Even assuming that the retention is as much as 25 per cent of the 8 cubic centimeters, the actual amount absorbed is only 2 cubic centimeters. This is the equivalent of 0.5 cubic centimeters of 2 per cent pontocaine,

or 0.8 cubic centimeters of 10 per cent cocaine, well below the toxic dosages of these drugs. Furthermore, the absence of large drops and pools of solution in the pharynx and mouth, plus the drugs and anesthetics administered to prevent the accumulation of saliva and to abolish the swallowing reflex, completely eliminates swallowing the toxic solutions.

The chief criticism of the procedure is that it is time consuming. It is true that a cooperative patient can be anesthetized more rapidly by some of the other methods. However, perusal of medical writings reveals the fact that many authors recommend a period of 20 to 30 minutes to obtain satisfactory anesthesia, and that one of the most frequent causes of poor anesthesia is failure to take sufficient time to apply the solution and await its maximal action.[2] In attempting to hasten the procedure, we have used stronger anesthetic solutions for shorter periods of time, and found that the anesthesia produced was not as widespread as that produced by using the recommended strengths for the full 30 minutes. This phenomenon is probably due to the small size of the particles produced by nebulizers, and the consequent slow surface coverage of the areas involved. This can be illustrated by aiming an atomizer spray and an aerosol of PSP toward filter papers that have been soaked in 10 per cent sodium hydroxide. Instead of reddening immediately as does the atomized paper, the nebulized paper gradually turns faintly pink and over a surprisingly long period of time finally becomes red.

There are apparently no dangers inherent in this method. The use of surface anesthetics always carries an element of risk[24-26] and reactions may occur in children and hypersensitive patients even with the use of minute amounts of drugs. Only one such reaction has occurred in our series. Early in the study, while using 2 per cent pontocaine, a 1½ year old colored girl began convulsing while being anesthetized for bronchography. Fortunately, she responded to the administration of intravenous barbiturates and oxygen inhalation, and suffered no ill effects.

The limitations of this method for topical anesthesia by nebulization of local anesthetics are as yet indefinable. Its use has met with success in many procedures requiring surface anesthesia of a widespread distribution by gentle application. In addition to the endoscopic aspects of surface anesthesia, it has been used for temporary relief of sneezing, the pain of severe pharyngitis and laryngitis, and for intractable coughing in tracheitis, bronchitis, and pertussis.

We are indebted to H. Bertel, M.D., attending anesthetist, for invaluable assistance and advice. For contributing cases and aiding in the

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SUMMARY

1) The conventional methods of obtaining topical anesthesia of the respiratory passages entail difficulties for the physician and discomfort to the patient.

2) A method of administration of topical anesthetics by nebulization is described in detail.

3) Nebulization anesthesia has proved successful and satisfactory for bronchoscopy, bronchography, bronchospirometry, and endotracheal intubation.

4) The success of this method is based on the particle size of the aerosol produced by the nebulizer.

5) This method is almost entirely free from the disadvantages and dangers of the conventional methods, and is accompanied by little or no discomfort to the patient.

RESUMEN

1) Los métodos convencionales de producir anestesia tópica de las vías respiratorias causa dificultades al médico e incomodidad al enfermo.

2) Se describe detalladamente un método de administrar anestésicos tópicos mediante la pulverización.

3) La anestesia de pulverización ha dado resultados satisfactorios en la broncoscopia, broncografía, broncoespirometría e intubación endotraqueal.

4) El buen exito de este método depende del tamaño de las partículas del aerosol producidas por el pulverizador.

5) Está casi exento este método de las desventajas y riesgos de los métodos convencionales y causa poca o ninguna incomodidad al enfermo.

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Diagnostic Bronchial Lavage in Tuberculosis*

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Diagnostic bronchial lavage in tuberculosis consists of washing of the tracheo-bronchial passages in order to search for tubercle bacilli. In patients who do not raise or who have negative sputa, gastric washings are often used. However, the gastric lavage do not satisfy completely and other tests have been tried: laryngeal swabs, search of bacilli in secretions collected through bronchoscope or through nasal tubes. de Abreu[1-12] in 1944, first tried diagnostic bronchial lavage in tuberculosis. He used injections of saline through the crico-thyroid membrane about 40 times with one fatal accident due to anesthesia. Fernandes[27,28] was the first to use the supraglotic method.

Technique

Bronchial lavage is easily performed; it is simpler than gastric lavage. Furthermore, it is tolerated better by the patient. The supraglottic region is anaesthetized by spraying it with a solution of 2 per cent pontocaine or 4 per cent cocaine. The spraying is done twice, with an intervening interval of 2 or 3 minutes; each application consists of eight to 10 ejections from an ordinary atomizer. The patient, while seated, should hold his tongue and breathe deeply. When he perceives a numbness on swallowing, the saline solution or sterile water is introduced. The patients tongue is held with a piece of gauze between the thumb and index finger and the chin between the index and third finger of the physician (Fig. 1). With the tongue out and fixed, the patient cannot swallow and the fluid enters the trachea and bronchi. The patient breathes rapidly (panting) while 20 cubic centimeters of fluid is introduced in two periods. Immediately the patient expels some of the fluid and later on, bending forward, coughs and expectorates the rest.

Bacilli are sought in the collected fluid by direct smears, cultures and animal inoculation.

The impression that bronchial lavage gives positive results only when the lesions are in the lower parts of the lungs is eroneous.

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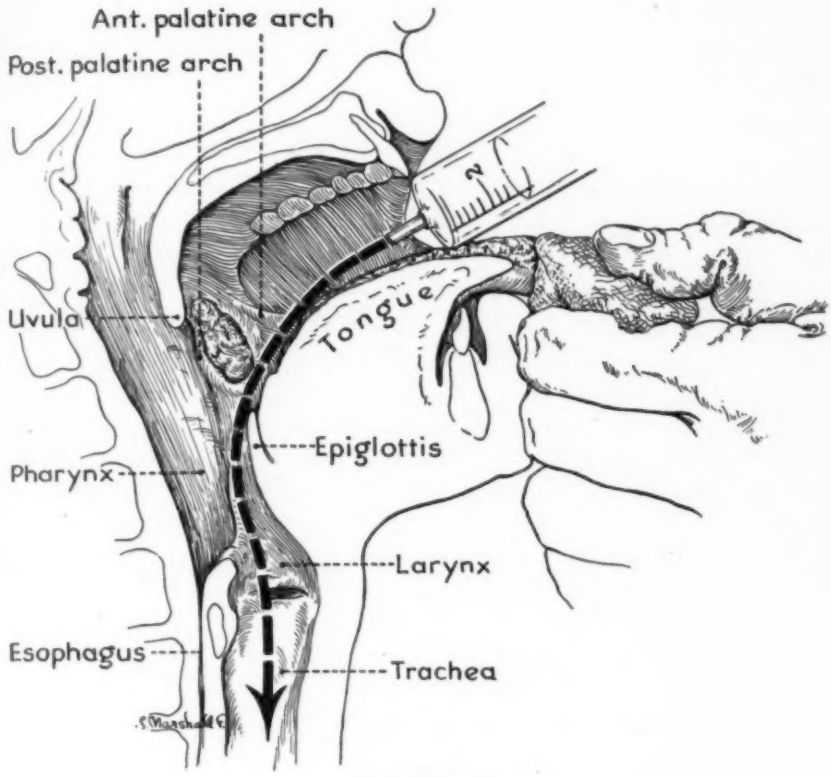

FIGURE 1

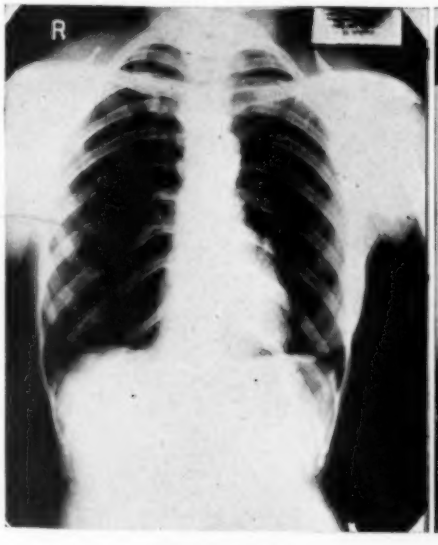

FIGURE 2

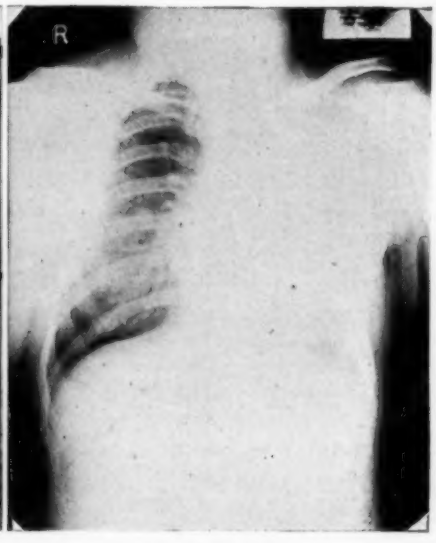

FIGURE 3

Fig. 2, M.J.: Infiltration left apex. Positive bronchial lavage. Negative gastric. No symptoms.—*Fig. 3, L.R.:* Left thoracoplasty April 1947. In 1948, two negative gastric lavages. Positive bronchial.

In 39 cases at Sassaquin Sanatorium, 15 positive results were obtained and in 12 the lesions were located only in one or both upper lobes.

Innocuousness

Bronchial lavage is harmless. About 200 have been performed in the United States and no accident has been reported. Over 3,000 lavages have been performed abroad. In Brazil, where the test first was tried, 2,000 have been done. Correa,[25] in Brazil, reported no serious accident, but 31 per cent of his patients presented allergic symptoms following the lavage. Usually the symptoms were mild and headaches prevailed. Fernandes[27,28] reported pain in the chest which lasted a few days following the lavage in 8 per cent of his patients. He thought the pain was caused by small foci of alveolitis. I have never observed such symptoms and neither has de Abreu[1-12] in his 1,741 lavages. The fear of the disease spreading, as it may following hemoptysis, is baseless. Only cases of apparently inactive or of low grade activity receive bronchial lavage.

Contra-Indications

Because this procedure needs the close cooperation of the patients, it is withheld from children under 12 years of age. In patients with severe impairments of pulmonary functions, hemop-

FIGURE 4

FIGURE 5

Fig. 4, C.R.: Fibrosis right apex. Last positive sputum September 1946, concentration. Since then, negative gastric, positive bronchial, January 1948.—*Fig. 5, J.H.:* Four years of left pneumothorax. Positive gastric in January 1948. Negative bronchial. Failure of bronchial lavage.

tysis (Castillo[21-23]), cardiac decompensation and bronchial asthma this procedure is contra indicated.

Must we try bronchial lavage if we already have a gastric lavage? The advantages of bronchial over gastric lavage are: (1) Technique easier for the physician; (2) Better tolerated by the patient; (3) Can be done at any time. Gastric should be done before breakfast and it must be performed as soon as he awakes; (4) The patient cannot deceive the physician as he can with a gastric lavage; (5) The acid-fast bacilli are not destroyed as they are by the gastric juice when stomach washings are not properly treated.

Comparison Between Bronchial and Gastric Lavage Showing Number of Negative and Positive Findings and Per cent of Positives

			Gastric	Bronchial
1.	1944—Rio de Janeiro, Brazil	Negative	17	10
	R. Fernandes and W. Hirsch[29]			
	Hospital Miguel Pereira	Positive	1	8
	18 cases		5.55%	44.44%
2.	1945—Buenos Aires, Argentina	Negative	70	66
	A. P. Heudtlass, J. A. Marti, A. Adamo[34]	Positive	0	4
	70 cases		0.00%	5.75%
3.	1946—Verona, New Jersey	Negative	9	4
	Marcio M. Bueno			
	Essex County Sanatorium	Positive	1	6
	10 cases		43.7%	60%
4	1947—Rio de Janeiro, Brazil	Negative	590	570
	M. Fontes Magarao and H. Linhares[40]			
	Tuberculosis Lab., Rio de Janeiro	Positive	110	130
	1,400 cases (2 groups)		16%	19%
5.	1948—New Bedford, Massachusetts	Negative	34	24
	Marcio M. Bueno			
	Sassaquin Sanatorium	Positive	5	15
	39 cases		12.08%	38.48%
6.	1948—Chicago, Illinois	Negative	22	22
	J. S. Bornstein[17]			
	Winfield Hospital	Positive	4	4
	26 cases		15.3%	15.3%
7.	1947—Utrecht, Holland	Negative	75	35
	K. Magnus and Van der Holden[41]			
	Dennenoord and Amerongen Sanatoria	Positive	58	98
	73 patients—266 cultures (gas. and br.)		43.6%	73.3%

In the 11 studies shown in the table, only two revealed a larger number of positive results in gastric than bronchial lavage. Number 10 is not a good example since only direct smears were made without cultures or inoculations. In number eight on inoculation, the gastric was more sensitive than the bronchial lavage. In number six Bornstein states, "Bronchial lavage is as sensitive as gastric lavage when the latter is done under optimal conditions. Bronchial lavage is another weapon to be used in detecting

Comparison Between Gastric and Bronchial Lavage

		Cases	
8.	1946: J. C. Rey and Abel Cetrangolo[43] Buenos Aires, Argentina	99	Direct smears and cultures—same proportion of positive results. Inoculation in guinea pig gastric—47% positive bronchial—34% positive
9.	1945: A. Chapchap and O. V. Cordeiro[24] Sao Paulo, Brazil	39	Direct smears only—29 negative with both procedures. 10—23% positive bronchial 15.3% positive gastric
10.	1945: R. Brandi and J. A. B. da Fonseca[19] Sao Paulo, Brazil	100	Direct smears only 76.98% positive gastric 63.36% positive bronchial 82.30% positive both procedures
11.	1945: S. A. Sarmiento[45] Buenos Aires, Argentina (intralaryngeal injection)	19	Direct smears: Bronchial—3 positive Gastric—0 positive Cultures—(11 cases) Bronchial—4 positive Gastric—3 positive Inoculation— Bronchial—11 positive Gastric—8 positive

Bronchial Lavage
Percentage of Positive Results

	Number of lavages	Positive	Per cent
Manuel de Abreu[1-12] (from August 1, 1944 to December 31, 1947)	1,741	293	16.8
Juan Castillo[21-23]	500		90
J. S. Bornstein[17]	75	12	16
M. M. Bueno	65	17	26.15
Magnus and Van der Holden[14]	133	98	73.3
D'ovidio and Bellingi[26]	366	78	20.86

tubercle bacilli in pulmonary diagnostic cases and in following quiescent or presumably arrested tuberculous cases in the office, clinic or out-patient." In numbers one, three and five, gastric lavages were done under "optimal conditions." In my cases only guinea pig inoculations were used. Fernandes[27-28] employed direct smears, cultures and inoculations. Magarao and Linhares[40] used direct smears and cultures (Loewenstein's medium). Bornstein[17] employed direct smears and cultures (Petragnani's medium).

Results at Sassaquin Sanatorium, New Bedford, Massachusetts

	Number of cases	Positive Bronchial	Positive Gastric
Suspected tuberculosis (on admission)*	17	5	2
Apparently arrested (on discharge)	18	8	1

*Suspected tuberculosis—cases of non-apparent, asymptomatic, pulmonary tuberculosis found either by mass x-ray survey done at the city clinic or by induction in the service.

CONCLUSION

Bronchial lavage has a definite place among the tests to detect tubercle bacilli. In patients suspected of pulmonary tuberculosis by x-ray, diagnostic bronchial lavage should be routine. Even if the gastric lavage were as sensitive as bronchial, the "optimal conditions" would make the former impractical. In mass x-ray surveys when minimal lesions are found bronchial lavage is the test of choice. Among cases for discharge from hospitals, a definite policy should be adopted in regard to tests. Almost every hospital differs. The most important is the interpretation of the clinical and radiological findings.

The danger of infection from gastric lavage-positive people is practically nil. This subject deserves further investigation.

CONCLUSION

El lavado bronquial tiene un lugar definido entre los procedimientos de investigación del bacilo de la tuberculosis. En los enfermos sospechosos de tuberculosis el lavado bronquial con fín diagnóstico debe hacerse de manera rutinaria. Aún en el caso de que el lavado gástrico fuese tan sensitivo como el bronquial, las "condiciones óptimas" harían el primero no práctico. En los catastros roentgenologicos, cuando se encuentran lesiones mínimas, el lavado bronquial es el procedimiento de elección. Entre los casos de alta de los hospitales, el lavado bronquial debe ser de rutina.

El peligro de infección por las personas que tienen lavado gástrico positivo, es practicamente nulo. Este asunto merece investigación ulterior.

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Discussion

HAROLD GUYON TRIMBLE, M.D., F.C.C.P.
Oakland, California

We became interested in this procedure some two years ago but did little about it until a few months ago. I can subscribe to what Dr. Bueno has told you, definitely. The problem from our standpoint is that we make every attempt to obtain tubercle bacilli, to be sure the disease in question is really tuberculosis, as well as to guide the course and duration of collapse therapy. In follow-up it is necessary to know the status of the patient's output of tubercle bacilli as well as surveying serial x-ray films. Life is getting complicated; formerly we said "this is our opinion," but now we endeavor to get the organisms.

The difficulty with gastric lavage is as stated. The technic must be meticulous and even in hospitals we have great difficulty in getting an intern to the patient before he is awake, before he smells food, before there is activity in the ward (because some wards start out pretty early). All these things stimulate gastric peristalsis and interfere with obtaining a positive gastric specimen.

A simple office procedure such as tracheal lavage is helpful

because it is difficult to get a dependable gastric lavage. If proper material is not obtained one cannot depend on negative results.

One other thing that has been of value. We can get positive cultures in as short a time as five days with some of the new technics, and many times within a week. We call our procedure not bronchial but tracheal lavage, because our procedure is more nearly that. However, as Dr. Bueno brought out that is probably a matter of the depth of the local anesthesia. Under deep anesthesia the patient should be bent over rather quickly to get the salt solution back. Otherwise within a little while it mostly disappears.

The details as Dr. Bueno has described them to you are important. They are simple. The doctor can do tracheal lavage in his office, in the hospital or sanatorium. It can be done at any time of the day. We have had no untoward results.

This procedure can be recommended because it is simpler than gastric lavage, equally effective and can be done more readily and at almost any time of day. The more we will use tracheal lavage the more we will know about our patients, with correspondingly better longtime results.

J. S. BORNSTEIN, M.D.
Chicago, Illinois

We have used this procedure in the office, the out-patient department, the clinic and the hospital. In my opinion there is a tendency to be somewhat over-enthusiastic about it. We had no untoward reactions in about 100 cases, but the method is just an adjunct to all other diagnostic procedures. I think it is more complicated than gastric lavage because one has to use topical anesthesia and that requires about 15 minutes in some patients, depending on personality. In some instances if one uses 2 per cent solution of cocaine or any of the other local anesthetics one can get material for culture from just using 1 or 2 cc. of cocaine dropped into the trachea. Cuthbert, an English phthisiologist, has shown that if one merely swabs the vocal cords, one can get a positive culture, and probably some of these positives come from tubercle bacilli on the vocal cords. It is important to determine when to terminate treatment, because I am sure that following thoracoplasty one can get positive bronchial lavages in almost any case. Termination of treatment is a matter of clinical judgment, and the fact that two or three tubercle bacilli can be recovered by bronchial lavage is not always important. In these days when calcification and pulmonary infiltration of unknown etiology are recognized, bronchial lavage is of value in detecting

tubercle bacilli; it is also a method of detecting various fungi. As a further aid, it may be of possible value in the detection of early bronchogenic carcinoma where the malignant growth is in one of the terminal segments. That remains to be proved. This suggestion may be of some interest in future investigations.

GEORGE W. HOLMES, M.D., F.C.C.P.
Chicago, Illinois

Our work on bronchial lavage at the Municipal Tuberculosis Sanitarium in Chicago has been rather limited, principally because it requires as much anesthesia to do an efficient bronchial lavage as to do a bronchoscopy. Therefore we have felt that by doing bronchoscopy and making a careful study of the specimens it would be interesting to see how they compared with stomach washings. The following report is submitted on 293 cases which were bronchoscoped at the Municipal Tuberculosis Sanitarium, Chicago.

The 293 cases represent admissions to the sanitarium or cases referred by its clinics. All cases had chest x-ray evidence of pulmonary disease and were considered to have pulmonary tuberculosis until proved otherwise. This work is a comparison of a single bronchoscopic specimen with all other tests done for isolation of tubercle bacilli, either in the sputum or stomach wash. The bronchoscopy was done for (1) suspect bronchial disease, (2) three or more consecutive negative 24-hour concentrated sputums after admission to the sanitarium and (3) preoperative study. There were no deaths or serious complications. All cases were reviewed six or 12 months later with subsequent tests for tubercle bacilli.

A bronchoscopic specimen could be aspirated in most all cases, although it may have been slight in some and it had to be aspirated with care. The volume of the specimen was never more than 2 or 3 cc. and collected in special sterile tubes and sent to the laboratory immediately. A small portion of the specimen was used for a gram stain and acid-fast stain and the balance was used for culture by the usual procedure on modified Tween 80 medium. Growth of the culture was usually present in nine to 30 days at the most, and the growth was faster and more luxuriant than from sputum or stomach wash specimens, apparently due to less contaminants. Positive direct smears of the bronchoscopic specimen for tubercle bacilli were always confirmed by a positive culture. The high percentage of direct positive smears of the bronchoscopic specimen was due to the fact that a skilled technician was in charge of the work. Approximately 200 cases were run before this

series was started, and various types of controls to check the sterility of the instruments, culture methods and smear method were done.

Group 1 represents all the cases in which the first and sometimes the only tubercle bacilli were found in the bronchoscopic specimens. Usually, the positive bronchoscopic specimen was confirmed by positive sputum or sputum culture later. Confirmation may take from one to 12 months following the report of the bronchoscopic specimen.

Group 2 represents the few cases in which a diagnosis was made by a positive stomach wash culture and guinea pig confirmation of tubercle bacilli. All sputums and bronchoscopic specimens were negative. Confirmation of the diagnosis was made by observation of the case.

Group 3 represents the cases in which the bronchoscopic specimen failed to confirm a positive sputum. Repeated bronchoscopic specimens with guinea pig innoculation would decrease this percentage.

Groups 4 and 5 represent the positive and negative cases confirmed by bronchoscopic specimens and probably act as the best controls of the procedures.

Stomach washes were not done in all the cases in Group 1 and, therefore, cannot be fairly evaluated. However, the bronchoscopic specimens can be obtained as easily as stomach wash specimens, and the bronchoscopic specimens are much easier to handle and process in the laboratory than either sputums or stomach wash specimens. In general, the bronchoscopic specimen seems to be more dependable than the sputum specimen, both on direct smear and culture for tubercle bacilli and also more dependable and accurate than the stomach wash findings. Bronchoscopic specimens are now being called for by our staff in questionable cases before discharge and where the other laboratory tests for tubercle bacilli fail to coincide with the x-ray and clinical findings.

The work of Holm in Denmark, reveals that sputum cultures of two to 30 colonies of tubercle bacilli are negative on direct smear. Our bronchoscopic specimen cultures often show only two to 12 and 16 colonies after 30 days of growth. This excellent study started by Holm can be carried even further by carefully obtained bronchoscopic specimens and the use of better culture medias and guinea pig inoculations for the determination of tubercle bacilli.

Recent Advances in the Conservative Treatment of the Giant Cavity*

DONATO G. ALARCON, M.D., F.C.C.P.
Mexico City, Mexico

A giant cavity is a huge excavation which involves the greater part of a lobe or a whole lobe. When it occupies more than one lobe, we do not speak of giant cavity but of lung emptying, "vaciamento pulmonar."

There are two types of giant cavities; and their differentiation is important since the treatment varies with the type. The first is the inflated, hypertensive giant cavity with a check-valve mechanism whose volume depends on the function of this valve. The second is the giant cavity following the progressive destruction of the surrounding tissue. The inflated cavity is not necessarily surrounded by infected lung tissue but can develop in almost healthy tissue, while the destructive cavity is necessarily surrounded by diseased tissue subjected to a more or less rapid process of destruction. While the differentiation between an inflated and a destructive cavity is sometimes easy, it is frequently difficult.

Radiologically, we can say that a cavity is valvular when it appears in tissue little affected by condensation and/or caseation. The volume quickly surpasses that of the initial lesion; its contour is spherical or oval with thin walls. The destructive cavity is also round until it reaches a certain size when it loses this characteristic and is molded by the thoracic wall, the fibrous tissue formation or other hard surrounding tissues. This type of cavity is surrounded by densely condensed tissue, partly diseased and partly compressed, which casts a heavy shadow. Usually this cavity has a slow progress, or it may progress rapidly in caseopneumonic process. It is seldom isolated and seldom corresponds to unilateral disease. On the contrary bilateral involvement is the rule.

Clinical observations offer different data:

The inflated cavity is usually silent. The destructive cavity, surrounded by solid conductive tissue gives the typical cavity syndrome, with expiratory cavernous breathing, coarse rales associated with sibilant rales. However, sibilant rales may occasionally be found in inflated cavities.

Radiologically we may observe the expansion of the cavity under

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cough strain, with a slow return to its original size. This phenomenon is not easily or frequently visualized.

In both types, the sputum is usually positive but in the destructive type the number of bacilli is greater for obvious reasons.

The technique that we wish to present concerns the treatment

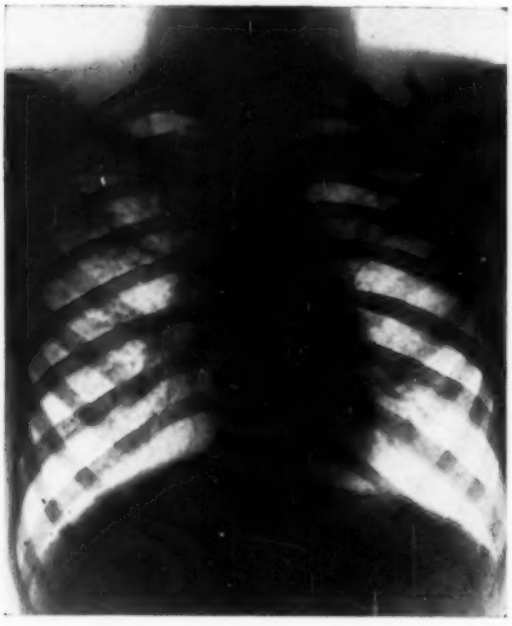


FIGURE 1, G.M.: Bilateral caseo-pneumonic lesions. Large apical cavity on the right side. Its limits are very close to the chest wall. Poor indication for the conventional extrapleural pneumothorax. On the left, a small cavity is located under the clavicle. Tubercle bacilli very numerous in sputum.

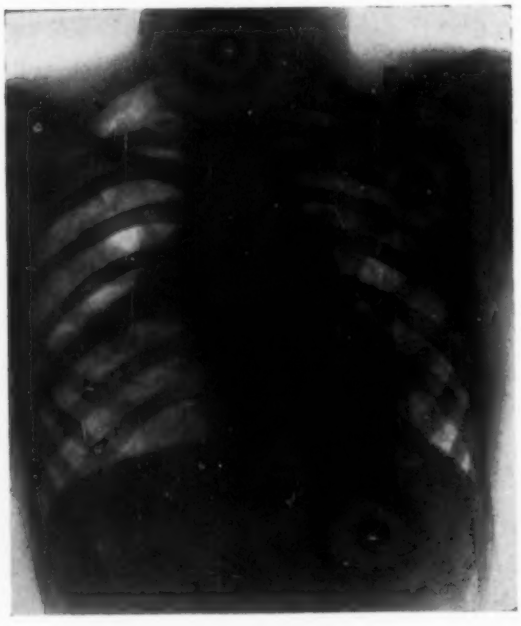
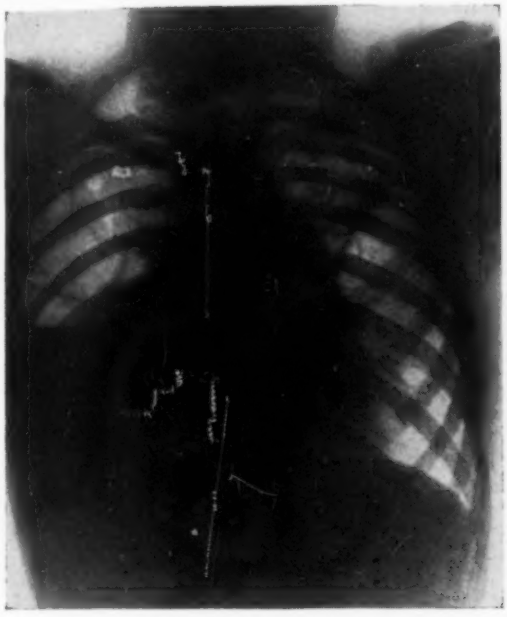


FIGURE 2, G.M.: As the pleurae were found adhered, a combination of upper three rib thoracoplasty and extrapleural pneumothorax as described, was done. The cavity fell and its size very markedly diminished.

of these two types of cavities which constitute one of the greatest difficulties encountered by the thoracic surgeon. These cavities react to pneumothorax in an inconstant and unpredictable manner. Intrapleural pneumothorax is sometimes attempted in spite of the slight chances of success. These attempts are justified by a



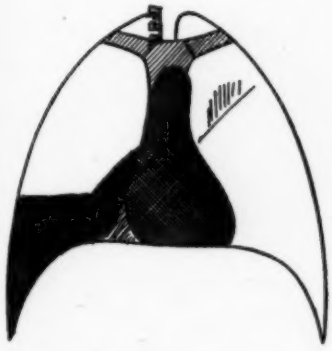


FIGURE 3, G.M.: The collapse was considered insufficient and a second stage was performed to enlarge the chamber and closure of the cavity was obtained.

FIGURE 4, G.M.: Conversion of the extrapleural chamber to oleothorax (mineral oil). The condition became immediately inactive. Sputum and gastric contents persistently negative, for over one year. Patient is leading normal life.

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rare favorable outcome, provided the pthisiologist will opportunely discontinue an inefficient or incomplete pneumothorax. An attempt at pneumothorax is also justified for ascertaining whether the pleura is free, even though it has been decided not to carry out a gaseous collapse. A free pleural space will modify the technique that must be followed.

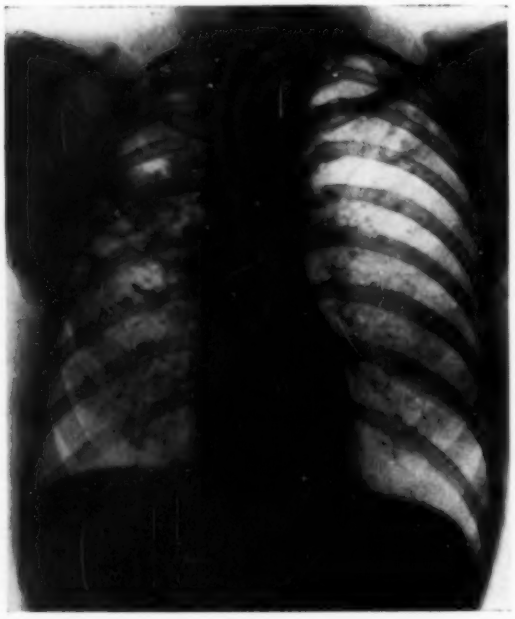

FIGURE 5, E.S.: Giant cavity in the right upper lobe and another smaller one underneath. Intrapleural pneumothorax was continued for several years on that side but was abandoned 14 years ago. A large nodule is visible under the left clavicle. Sputum: Tubercle bacilli very numerous.

FIGURE 6, E.S.: To avoid thoracoplasty and deformity, the combination thoracoplasty-extrapleural pneumothorax was performed with excellent results. The upper lobe seems to be collapsed and the cavity closed and protected from perforation by the soft tissues left on the surface of the lobe.

Before any therapeutic decision is carried out, the bronchial patency must be determined by means of needling the cavity. This puncture will indicate if the cavity is hyper- or hypotensive, and thus, if the bronchus is constantly open or not. The changes in intracavitary pressure may be observed after coughing as air enters the bronchus and the time necessary for its return to the

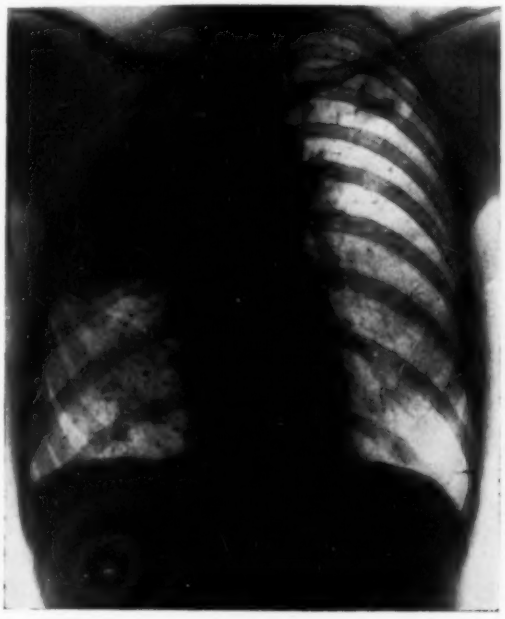

FIGURE 7, E.S.: Conversion to oleothorax with 1000 cc. Nujol when the chamber was filled up.

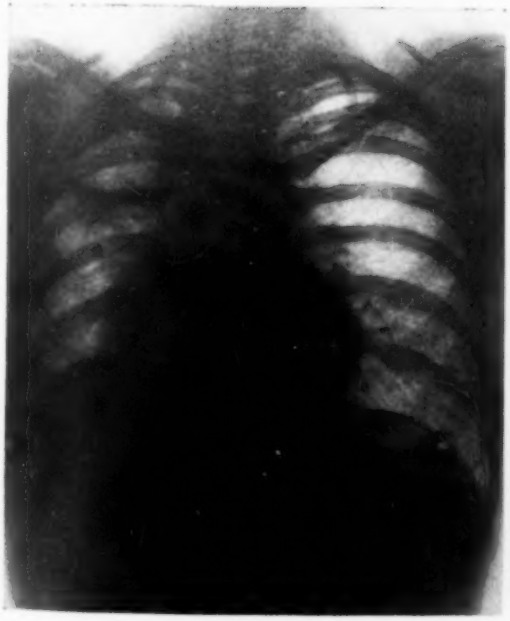

FIGURE 8, E.M.: Giant cavity in the right upper lobe and exudative spread over the lower lobe and the opposite lower lobe. Sputum: very large number of tubercle bacilli.

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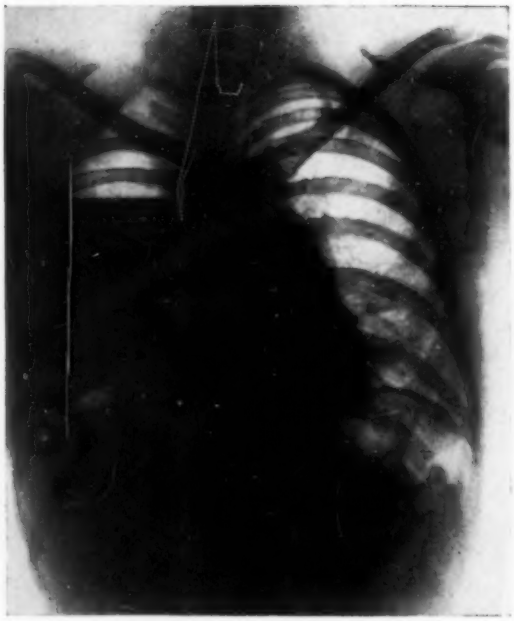
initial pressure is noted. This procedure should be carried out only when pleural synechia is present at least within the area of the thoracocentesis.

Besides intrapleural pneumothorax which is frequently inefficient in the treatment of these cavities, we have other conservative and radical recourses. The conservative methods are Monaldi's

FIGURE 9, E.M.: Large extrapleural chamber is obtained after the combination of thoracoplasty - extrapleural pneumothorax is done.



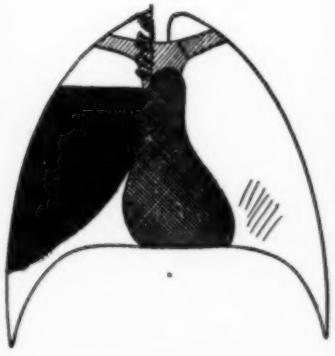


FIGURE 10: E.M.: Conversion to oleothorax to make a permanent collapse. Sputum and gastric contents repeatedly negative.

intracavitary aspiration, extrapleural pneumothorax, and other nondeforming extrapleural operations. The radical procedures are: extensive thoracoplasty and pulmonary resection.

Thoracoplasty and resection are both disfiguring because pneumonectomy and lobectomy in tuberculosis must be followed by thoracoplasty. Especially in lesions that are rarely unilateral, thoracoplasty before or after pulmonary resection must be carried out if we do not wish to provoke flare-ups in the remaining lung.

We advocate the treatment of giant cavities by conservative methods for several reasons:

1) Usually the patients are young and their future is affected by great disfigurements such as that caused by an extensive thoracoplasty as must be done in these cases.

2) The most extensive thoracoplasty may fail to collapse a giant cavity and may only result in an incomplete closure.

3) Pulmonary resection has a greater operative risk in bilateral cases.

Extrapleural methods are preferable to those like the Monaldi method because we consider that eventually, as in most cases of giant cavity, these methods lead to a complementary thoracoplasty. However, we admit that in some expert hands the Monaldi intervention is efficient in an unexpected manner.

With reference to extrapleural pneumothorax, we have already published several works which try to justify the use of this method by presenting examples of the good results. It is particularly indicated in the inflated cavity where there is a thick layer of healthy tissue between the cavity and the thoracic wall allowing a separation far from the cavity.

We do not recommend extrapleural pneumothorax for cavities of the destructive type so huge that they seem to be limited in size by the thoracic wall, because of the great risk of provoking an early or late perforation with subsequent empyema. This type of cavity contraindicates conventional extrapleural pneumothorax. That is why our efforts have been directed towards evolving a technique which will avoid the aforementioned disadvantages but offer reasonable hopes for the closure of the cavity.

The standard extrapleural thoracoplasty with a more or less extensive rib resection but without apicolysis does not solve the problem in the majority of cases. Semb's thoracoplasty more frequently solves this problem though not always, and leaves great disfigurements because of the extensive resections needed in two or three stages. Sometimes, after all these steps, we find that the cavity has not closed but eludes collapse by just descending and decreasing in size. Then secondary pneumonectomy is justified.

However, both thoracoplasty and this latter operation deform

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the thorax and we do not believe this is justified if there is a conservative method which, without deformity, and in one or two stages, will accomplish the same or even better results than an extensive thoracoplasty.

In order to avoid the disadvantages of extrapleural pneumothorax and thoracoplasty, we have combined the two operations with the following advantages:

FIGURE 11, A.M.: Large apical cavity on the upper lobe. Pleural synechia.

FIGURE 12, A.M.: The combination thoracoplasty - extrapleural pneumothorax was done.

a) A collapse equally extensive or more so than that obtained by thoracoplasty.

b) There is no appreciable disfigurement even in the naked thorax.

c) The lung is protected, so that this type of cavity is not liable to rupture as in the usual extrapleural pneumothorax.

d) It is a permanent procedure like thoracoplasty.

Technique for Extrapleural Pneumo-Oleothorax Combined with Apical Thoracoplasty

This is a preliminary report of our treatment of giant cavities by this technique. To-date our results have been very satisfactory.

The operation is carried out with endotracheal ether-cyclopropane anesthesia, with frequent aspirations. The incision is the usual for a thoracoplasty, that is, the paravertebral incision including skin and muscles. The first steps of the procedure are performed like a three rib thoracoplasty, resecting almost all of the third rib and all of the first and second ribs in the order mentioned. This resection is intraperiosteal, the periosteum is left "in situ." We wish to emphasize that in this operation it is not necessary to resect the transverse process or to disarticulate the ribs.

From this step forward the operation is carried out as in Semb's thoracoplasty, differing from this author's technique in a few details that are important: first, we try to conserve all the soft

FIGURE 13, A.M.: Conversion to oleothorax. Sputum and gastric lavage negative.

tissues that cover the lung anteriorly, laterally and posteriorly, so that we maintain the adhesion of the periosteum, intercostal muscles, blood vessels and nerves to the parietal pleura. It is through this adhesion that we try to protect the cavity wall.

Then the lung is separated by blunt dissection on its mediastinal aspect down to the hilum, with extreme care because of the danger of injuring blood vessels, nerves, lymph nodes and the thoracic duct. Then the muscles, intercostal vessels and nerves are cut after ligature; the section is done as far anteriorly as possible as well as posteriorly. Thus the lung stump falls vertically and a first stage of Semb's thoracoplasty has been carried out with slight variations, but now instead of limiting ourselves to the separation and descent of the apex, we also make an extrapleural decollation as low as is anatomically possible, leaving a subtotal extrapleural space. Sometimes we leave a drainage at the lowest point, depending on the hemorrhage, and suture in two layers.

The operation is well tolerated and we attribute this to the anti-shock treatment of the present day, including generous transfusions. Twenty-four hours later we withdraw the drainage tube and occlude the course of it. The extrapleural pneumothorax is maintained in the usual manner and approximately one month later we convert it to oleothorax.

The examples presented show that a greater collapse is obtained than in thoracoplasty or even in Semb's operation. We have found, in our limited experience, that the soft tissues protect the cavity from perforation and our experience for over 10 years with mineral oil in extrapleural pneumothorax has shown us it is well tolerated.

The aim of this procedure is to obtain a permanent collapse in one operation. Sometimes we reoperate if the collapse is insufficient. This brings no further disadvantages since there is no disfigurement of the thorax. This operation must not be confused with similar procedures in which costal resection is carried out including the periosteum and intercostal vessels, since, on the contrary, owing to the sparing of these tissues we have obtained satisfactory results.

RESUMEN

Las cavernas gigantes pueden dividirse en dos grupos, las infladas con poca destrucción tisular y las destructivas con pérdida de tejido muy considerable, limitándose a veces aparentemente por la pared torácica.

Estas cavernas son difíciles de ocluír por los recursos de colapso habituales y cuando se logra es a costa de grandes deformaciones que afectan el futuro de los sujetos jóvenes.

La toracoplastía sea desde luego o después de neumonectomía es la intervención obligada.

A fin de evitar las operaciones deformantes el autor presenta una técnica quirúrgica consistente en una combinación de toracoplastía apical de tres costillas a la manera de Semb con modificaciones pequeñas, con un neumotórax extrapleural desde la cuarta costilla hasta el surco costo diafragmático. Toda la operación se realiza en un tiempo o en dos cuando más.

Después de un mes el extrapleural combinado se convierte en oleotórax con el fin de obtener un colapso permanente.

El aceite mineral es bien tolerado según su experiencia en oleo extrapleural que sobrepasa diez años.

Las ventajas que presenta el procedimiento son las siguientes:

a) Realiza un colapso tan extenso o más que el de una gran toracoplastía.

b) No ocasiona deformación del tórax en forma apreciable ni aún en el tórax desnudo.

c) No expone a perforación de la caverna y empiema consecutivo como el extrapleural corriente si se aplica a caverna gigante.

d) Es un método permanente como la toracoplastía.

e) Puede habitualmente realizarse en un tiempo.

Presenta algunos ejemplos de esta técnica.

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Surgery in Congenital Heart Disease*

RALPH ADAMS, M.D., F.C.C.P.**
Woodbury, Tennessee

Introduction

The large subject of congenital heart disease may be submitted to an over-simplified and incomplete but practical subdivision into a cyanotic and a non-cyanotic group. The cyanotic group includes tetralogy of Fallot, truncus arteriosus and cor triloculare; while in the non-cyanotic group are found patent ductus arteriosus and coarctation of the aorta. The cyanotic group may be further subdivided into those cases characterized by inadequate oxygenation in the lung, and those with reduced flow of blood to the lung. Of those with reduced pulmonary flow, tetralogy of Fallot, cor triloculare and truncus arteriosus are amenable to indirect surgical relief. The tetralogy with the Eisenmenger complex, transposition of the great vessels, and aortic atresia have not as yet successfully been submitted to surgery.

The fact that certain types may be greatly benefitted by surgical therapy has required effort to make an accurate diagnosis and estimate prognosis, to obtain help in deciding what type of operation to do, and to establish criteria for objective evaluation of the results. These needs are responsible for the reinvestigation and application of many old well-known physiologic facts, and the development of some new procedures for study.

Patent Ductus Arteriosus

The first form of congenital heart disease to be attacked surgically was patent ductus arteriosus. The high incidence of bacterial endocarditis, the frequent disability and the short life expectancy led Strieder first to attempt ligation of the persistent patent ductus. Unfortunately, his patient died and to Gross goes credit for the first successful ligation; and to his medical colleague Hubbard goes commendation for the courage to recommend and allow this then unproved operation to be performed on his patient. Because some of the cases have recanalized or a patent canal has persisted, Gross proposed and has practiced division of the ductus in most of his cases. Infected cases of subacute bacterial endocarditis have become infection-free following the operation, and the majority done have shown great functional improvement.

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*Presented at the 6th Annual Meeting of the Southern Chapter, American College of Chest Physicians, Miami, Florida, October 25, 1948.

The diagnosis of patent ductus arteriosus usually is easy to make. The patient may appear pale or thin, and sometimes slightly cyanotic. In other cases there is an accentuated ruddiness of complexion. The heart is somewhat enlarged and there is a machinery or to and fro murmur loudest over the pulmonic area. The pulmonary conus (Fig. 1) is very prominent and fluoroscopically there is a "hilar dance" and pulmonary congestion. In other cases the possibility of associated anomalies like intracardiac septal defect, or absence of the pulmonary artery must be considered. For this purpose the cardiac catheter (Figs. 2A and 2B), developed by Cournand and associates, has proved useful in obtaining intracardiac pressure readings and samples for blood gas analysis.

The problems of diagnosis and treatment in patent ductus arteriosus may be illustrated by a case example (L.T.). A child of 10, poorly developed, pasty of appearance and slightly cyanotic had disabling dyspnea on exertion. His condition in the past year had grown steadily worse and it was the consensus that he would shortly die. A cardiostethogram (Fig. 3) portrays graphically the machinery murmur. Because of the very loud systolic

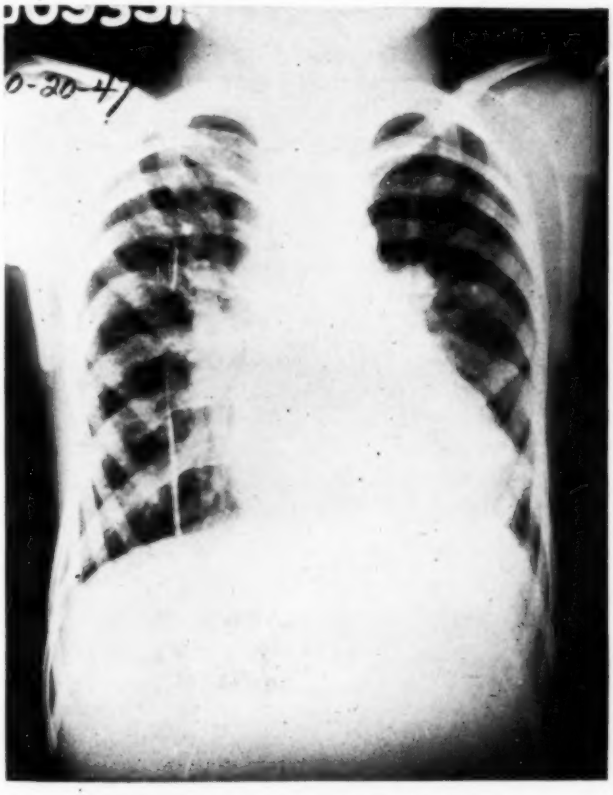

FIGURE 1: Patent ductus arteriosus.

murmur, an intracardiac septal defect was also suspected. The known large size of the ductus and a wide pulse pressure of 120/50 aroused fear that the ductus might be providing the principal pulmonary flow. Therefore, catheterization of the right heart was done. The blood gas determinations from the catheter sample are shown in Table 1.

TABLE 1

Heart Catheterization Study (L.T. 10/1/47)

Findings from blood gas analysis in patent ductus arteriosus.

	O_2 Content	Per cent Saturation	Pressure MM. Hg
Right Ventricle	12.75 V/%	69.9	25
Right Auricle	12.75 V/%	69.9	10.7
Superior Vena Cava	....	...	1.5
Femoral Artery	17.54 V/%	96.3	110/30
O_2 Capacity	18.25 V/%	RBC 4.5 M.	Hgb 13.4 G.

These prove that there is no intracardiac shunt; there is inflow and outflow to the right ventricle; the amount of outflow is normal, since the right ventricular pressure is within normal limits, and the right auricular pressure is not increased (absence of venous stasis). Final and confirmatory proof of demonstrated higher pressure in the pulmonary artery than in the right ventricle

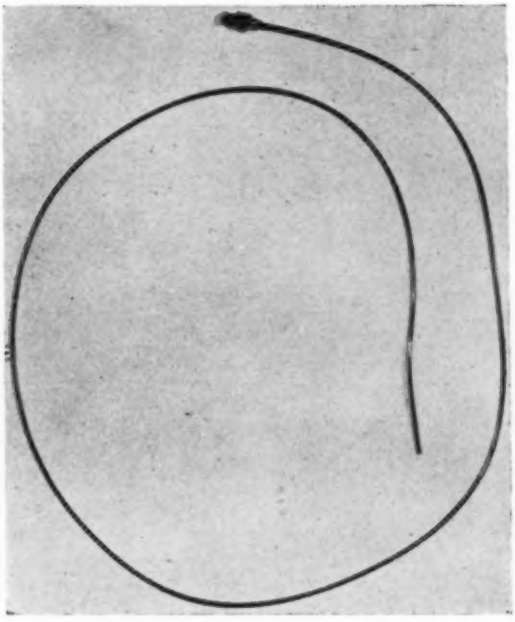

FIGURE 2A: Cournand cardiac catheter.

could not be obtained because the catheter could not be successfully passed into the pulmonary artery. The basal metabolism was elevated at plus 30, and the oxygen consumption was 170 cc. per minute, indicative of increased oxygen usage.

From these data the cardiac output and pulmonary flow were calculated according to the Fick principle (Table 2 and Table 3). The pulmonary net shunt amounted to 20 cc. per minute. Therefore, from these studies we were justified in concluding that the child had patent ductus arteriosus, and that he did not have any other cardiac anomaly.

TABLE 2

The Fick Principle (Cardiac Output)

1. Total Output (cc's/min.) =

$$\frac{O_2 \text{ Consumed in cc's/min.}}{O_2 \text{ Cont. Art. B. Vol. \%} - O_2 \text{ Cont. Mix. Ven. B. Vol. \%}} \times 100$$

2. Systemic Flow (cc's/min.) =

$$\frac{O_2 \text{ Consumed in cc's/min.}}{O_2 \text{ Cont. Art. B. Vol. \%} - O_2 \text{ Cont. R. Aur. B. Vol. \%}} \times 100$$

TABLE 3

Heart Catheterization Study (J.H. 10/14/47)

	O_2 Content	Per cent Saturation	Pressure MM. Hg
Right Ventricle	6.29 V/%	61	32
Right Auricle	3.74 V/%	33.5	. .
Femoral Artery	5.5 V/%	53	130/50
O_2 Capacity	10.4 V/%	RBC 4,810,000	Hgb 7.6 G.

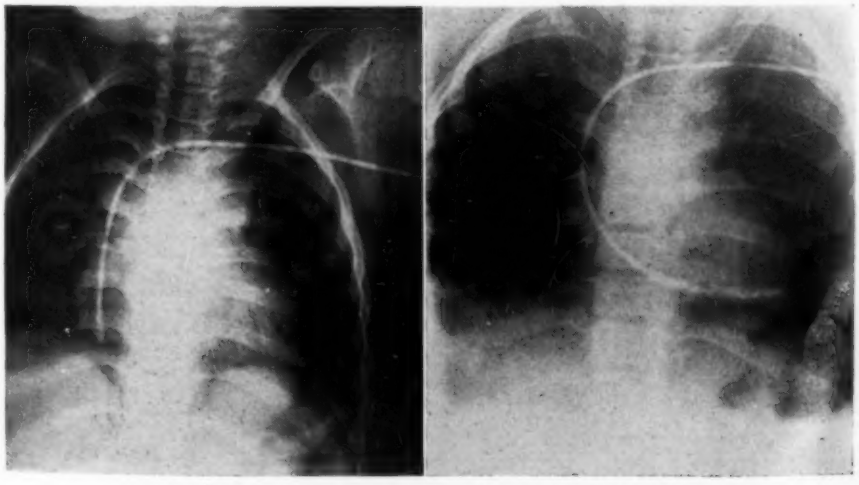

FIGURE 2B: Catheter in right heart chambers.

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The ductus was ligated and the child is much improved, and is able to lead a normal life. It was not divided, although such is our preference, because of the critical nature of his illness and the likelihood that he would not survive the operative procedure. This is the only ligation we have done. Our other cases have been treated, after the method of Gross, by division. Postoperatively the basal metabolism was reduced and the pulmonary conus became smaller. We have closed the ductus in three cases by division and in 1 by ligation. In a fifth case, the ductus spontaneously ruptured on the anterior wall with fatal hemorrhage as it was being exposed, and before any sutures or clamps had been applied.

Coarctation of the Aorta

Coarctation of the aorta, another of the non-cyanotic types of heart disease, is recognized by a high blood pressure in the upper extremities, a very low or absent blood pressure and absence of pulsations in the lower extremities and notching of the ribs by x-ray examination. The notching is caused by pulsations of enlarged collateral vessels against the ribs. In the diagnosis of this disease one is faced with an outflow problem, in contrast to most forms of congenital heart disease, in which the diagnosis is largely on the basis of inflow data. Angiocardiography is a method of

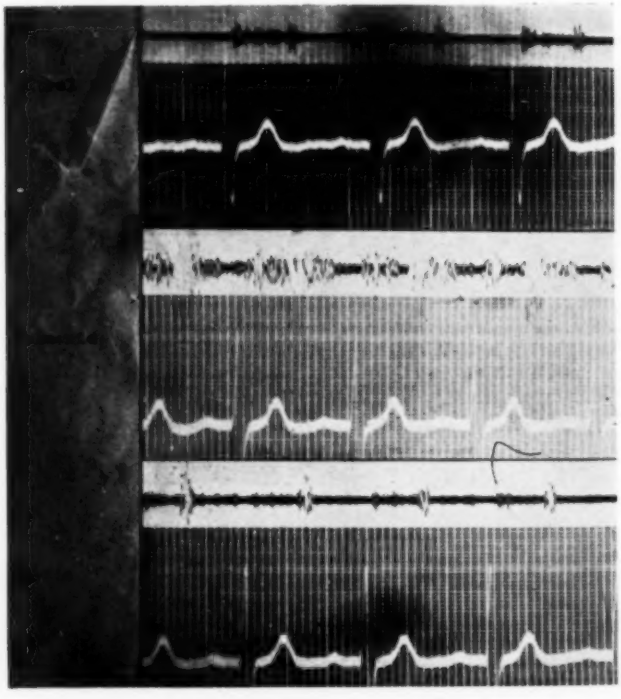


FIGURE 3: Cardiostethogram in patent ductus arteriosus.

determining cardiac outflow characteristics and is interesting but not usually necessary for diagnosis. Two operative procedures may be employed for the relief of coarctation. One is by means of a shunt around the stricture, which is usually located in the aortic arch just below the subclavian origin. This consists in the anastamosis of the greatly enlarged left subclavian artery to the diminutive aorta distal to the shunt. The other procedure, proposed by Crafoord, is resection of the stricture and end to end anastomosis to the aorta. Bradshaw has developed an ingenious clamp (Fig. 4) for occluding the aortic blood flow during the period of anastomosis. The accompanying photograph shows an aortic stricture which was excised (Fig. 5) with end to end anastomosis. Although the anatomic and circulatory results were good, the hind quarters suffered motor paralysis which we fear will be permanent.

Tetralogy of Fallot

Uncounted numbers of anatomists, from Galen forward, established the normal anatomy of the heart and the primary vessels. The great Maude Abbott, by her lifetime of observation, collection, recording and writing, did more than any other person perhaps, to classify and clarify the pathologic anatomy of congenital heart disease. Fick, Haldane, Carpenter, Van Slyke, A. V. Hill, and many others in the past century developed principles and procedures by which blood flow, pulmonary ventilation and blood gas components may be measured or established with reasonable accuracy. Cournand introduced the cardiac catheter which permits the direct analysis of pressures and blood samples obtained from the right side of the heart, and which has signif-

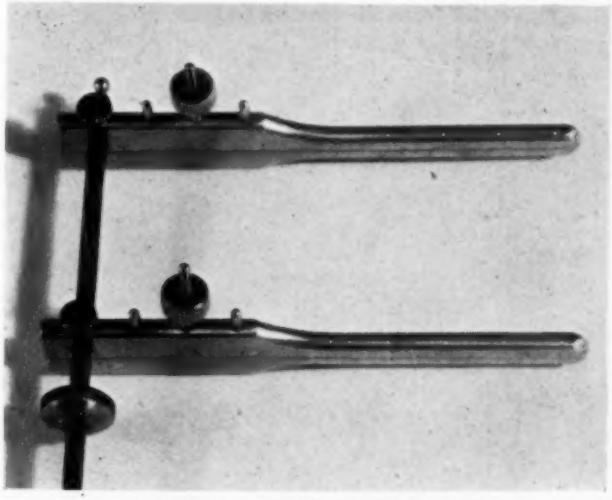


FIGURE 4: Bradshaw aorta clamp.

icantly extended the usefulness of physiologic methods of previously mentioned workers.

The brilliant American scientist, Alfred Blalock, and the astute clinician, Helen Taussig, in 1945, on the basis of these many preceding contributions, made available a surgical procedure for the relief of certain types of congenital heart disease with cyanosis. They reasoned that the essential fault in tetralogy of Fallot is deficient blood flow through the pulmonary circulation. The Blalock-Taussig operation is designed to increase the flow through the lungs by diverting a portion of the systemic circulation into the lungs by means of an anastomosis between the innominate or subclavian and pulmonary arteries. In other words, an artificial patent ductus is made.

Tetralogy of Fallot is a form of congenital heart disease caused by overriding or dextroposition of the aorta, in which the aorta arises lower than normally from the left ventricle and over the right ventricle. Because of the abnormal origin, the aortic septum can not meet the ventricular septum and a high interventricular septal defect results. There is stenosis of the pulmonary orifice,

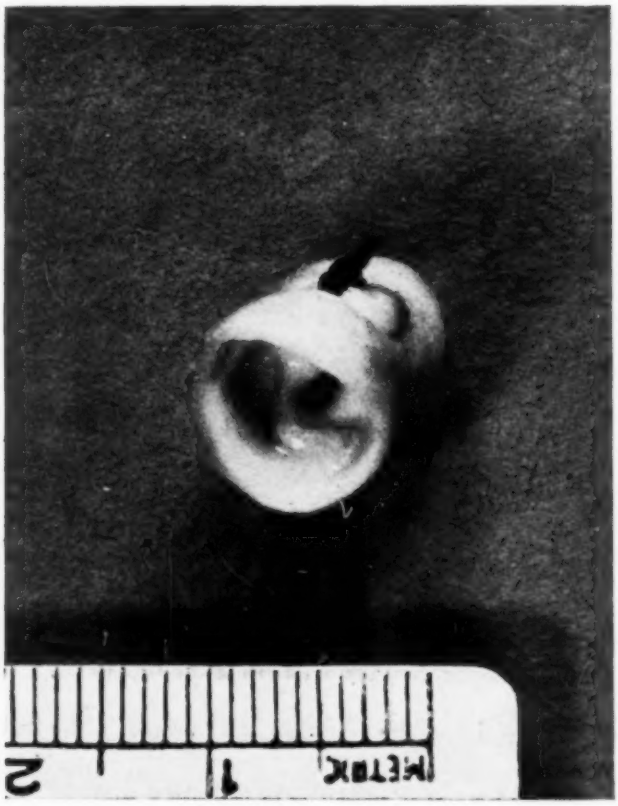
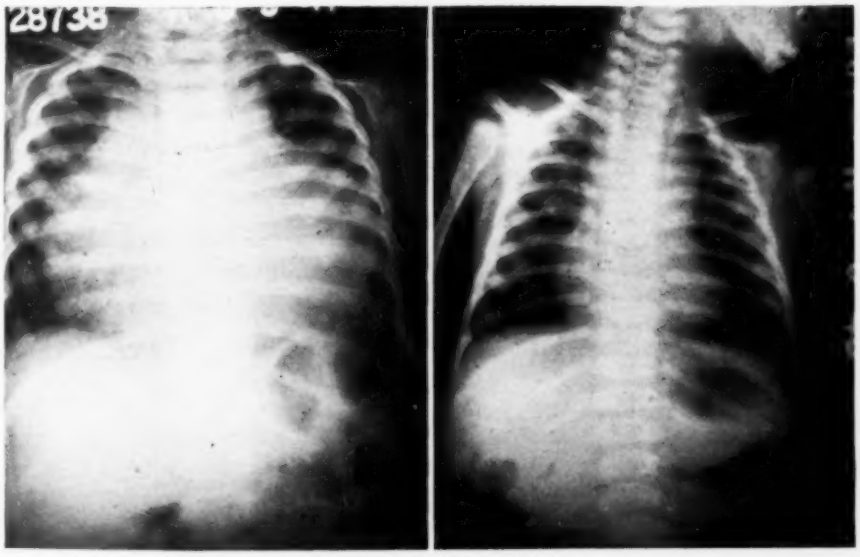


FIGURE 5: Coarctation of aorta specimen.

which often extends out onto the pulmonary conus, and accounts for the concavity at the base of the left heart border so often seen by x-ray examination in such cases. The difficulty of getting blood out of the right ventricle causes elevation of pressure and right ventricular hypertrophy, and right axis deviation by electrocardiographic observation. The features of tetralogy of Fallot then are: overriding of the aorta, pulmonary stenosis, an interventricular septal defect, and right ventricular hypertrophy.

The signs of tetralogy of Fallot are: cyanosis, clubbing, usually a systolic murmur along the left sternal border, but not necessarily a diastolic murmur. Some hearts are very large; others are not enlarged at all. The child as a rule is poorly developed and nourished. Some older children are mentally retarded as a result of chronic anoxemia. If markedly cyanotic, they are extremely dyspneic on even slight exertion. Venous congestion is frequently observed in the upper extremities, on the bridge of the nose, and in the arms. Fluoroscopically, there are no hilar or pulmonary pulsations visible, and instead of a pulmonary conus convexity there is a concavity. This is also known as a pulmonary window. The x-ray picture in the left anterior oblique position is that of a rounded or blunt heart with a narrow aorta and a clear area posteriorly. The right ventricle is enlarged. By electrocardiographic studies, right axis deviation usually is found. The peripheral oxygen saturation is low. The aortic knob is variable in position; sometimes curving to the right and sometimes to the left. The



A B

FIGURE 6A: Tetralogy of Fallot in failure.
6B: Same, before failure.

position of the aortic arch must be determined and may be done by fluoroscopy with barium to show the position of the esophageal indentation as it passes behind the aorta. The chest, both by physical examination and by x-ray examination is often found to be barrel-shaped from hyperpulmonary ventilation. A typical posture of such children is a squatting position and they are referred to colloquially as "squatters."

Tetralogy cases with deteriorating condition and who are not eating, may become less cyanotic and the red count drop 2 or 3 million. This is no doubt caused by anemia of malnutrition and is a grave sign. In such cases one may expect the heart to enlarge. The massive enlargement that can occur is shown in the two following comparative slides of a child failing rapidly (Figs. 6A and 6B). In the figures shown from catheter study, note the anemia as well as severe oxygen unsaturation (Table 4).

TABLE 4

The Fick Principle

Findings from blood gas analysis in tetralogy of Fallot.
Case in heart failure from malnutrition.

3. Pulmonary A. Flow (cc's/min.) =

$$\frac{O_2 \text{ Consumed in cc's/min.}}{O_2 \text{ Cont. P.V. Vol. \%} - O_2 \text{ Cont. P.A. Vol. \%}} \times 100$$

4. O_2 Content P.V. (Vol %) = % O_2 Sat. P.V. $\times$ O_2 Capacity Vol. %

Assumption—P.V. Blood is 95% Saturated

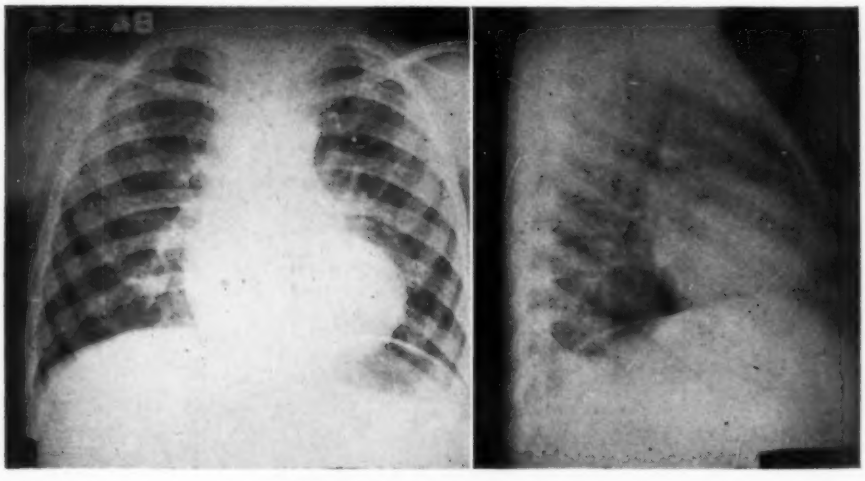


FIGURE 7: Pulmonic stenosis.

It is not the cyanosis that is harmful in congenital heart disease, but the peripheral anoxemia which causes it and the compensatory polycythemia. The blood returning from the lungs by way of the pulmonary vein in the majority of heart cases is fully or 95 per cent saturated. This has been confirmed by indirect colorimetry, by calculations according to the Fick principle, and by a few successful catheterizations of the pulmonary vein through an open septum in cases that were deeply cyanotic. These cases provide the only purely objective proof that the theory of Blalock and Taussig is correct in stating that the essential defect is deficiency of blood flow rather than deficiency of oxygenation of the blood that is able to reach the lungs.

There are three principal types of congenital heart disease with cyanosis: tetralogy of Fallot comprises perhaps 75 per cent of these, in which the cyanosis is dependent largely upon the size of the right-to-left shunt, and the pulmonary stenosis (Fig. 7). In cor triloculare, there is a common ventricle with or without a rudimentary outlet chamber. The cyanosis is deep or slight, depending on whether the outlet vessel to the lung is large or small. In truncus arteriosus, cyanosis is slight or absent if the pulmonary artery arises off the aorta. It is intense if the pulmonary circulation is limited to flow through the bronchial arteries. The pulmonary stenosis patient may not be cyanotic at first, but become so later as the patent ductus shuts off, thereby decreasing the blood flow into the lungs. Theoretically, one can use oxygen intravenously to supplant that absorbed by the lungs. However, the amount that can be administered is limited to that which

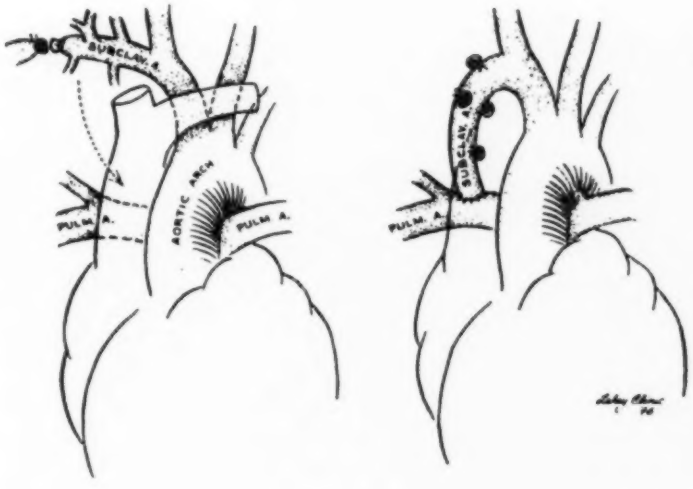


FIGURE 8: Subclavian to pulmonary artery anastomosis—Diagram.

will go into chemical solution in the blood, and is only about 1 per cent. We have used this method in one case that became seriously cyanotic during operation. The patient died 9 days later of a cerebral thrombosis, and may have had air embolism through the septum as well.

The purpose of the corrective operation (Fig. 8) is to compensate for an adequate flow of blood to the lung. Blalock has advised that one enter the thorax for operation on the side opposite that of the aortic arch, because of the more favorable curvature that the subclavian artery will assume off the innominate as compared to the aortic arch. We have found the left subclavian off a left arch quite satisfactory in 4 cases in which it was used. Either the subclavian or innominate artery is sutured by its end into the side of the pulmonary artery. The use of the subclavian does not seriously endanger the viability of the arm, although a dorsal sympathectomy at the same time is wise in older patients. The sacrifice of the innominate artery dangerously jeopardizes the blood supply to the brain, and significantly increases the mortality of the procedure. Before doing the operation, one should temporarily occlude the pulmonary artery to make certain that its occlusion will be tolerated. It is also wise to measure the intrapulmonary arterial mean pressure, as pressures above 300 mm. of saline indicate that there is probably sufficient blood entering the pulmonary artery. Likewise, the artery should be released slowly after the anastomosis to avoid severe changes in blood pressure and acute pulmonary edema. If a large amount of collateral circulation is found on opening the thorax, it suggests pul-

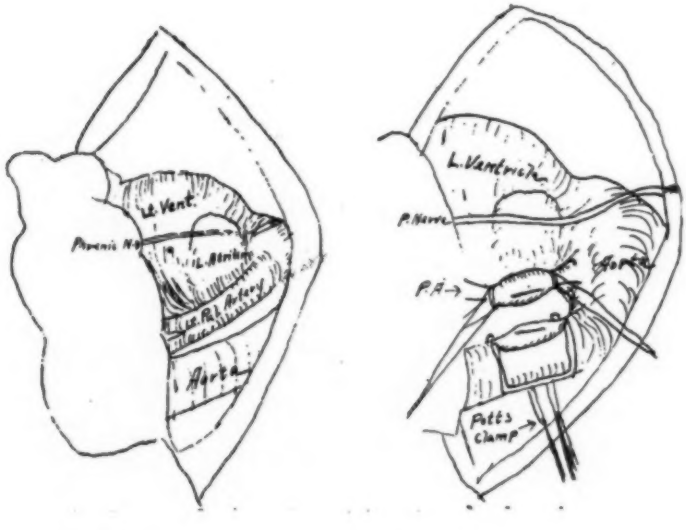


FIGURE 9: Aorta to pulmonary artery anastomosis—Diagram.

monary atresia. The lung should be reinflated very gradually in these cases lest the pulmonary alveoli be ruptured and artificial pneumothorax be caused bilaterally. The heart may increase in size postoperatively, but most of the increase is limited to the first three weeks. We have not used heparin and dicumarol either pre- or postoperatively. Blood-letting preoperatively to reduce viscosity has been tried, but caused a physiologic crisis and the blood had to be replaced. The disadvantage of the subclavian artery anastomosis is the small caliber of the vessel. There is danger that the opening may thrombose from polycythemia. I have already mentioned the disadvantages of the innominate anastomosis.

To overcome some of these disadvantages and to make the operation available to very small children, Potts has carried out a direct anastomosis of the aorta to the pulmonary artery (Fig. 9). The photograph shows the clamp (Fig. 10) that is used to occlude one wall of the aorta and still allow blood to pass through to the lower extremities during the procedure. An anastomosis about 8 to 9 mm. in length is made with very fine silk. This is another method of constructing an artificial ductus and here in diagrammatic form is the way the operation is done. We have encountered no technical difficulty in the use of this method in 4 cases, and have achieved a most satisfactory result in 2 cases. Each of the other two children died of progressive hemorrhagic pulmonary edema about 24 hours afterward. At autopsy in each the anastomosis was found intact. In one the anastomosis was thought to be too large; in the other there was but a single ventricle. We have had one death in 5 cases of subclavian pulmonary anastomosis. This occurred from cerebral thrombosis in a woman of

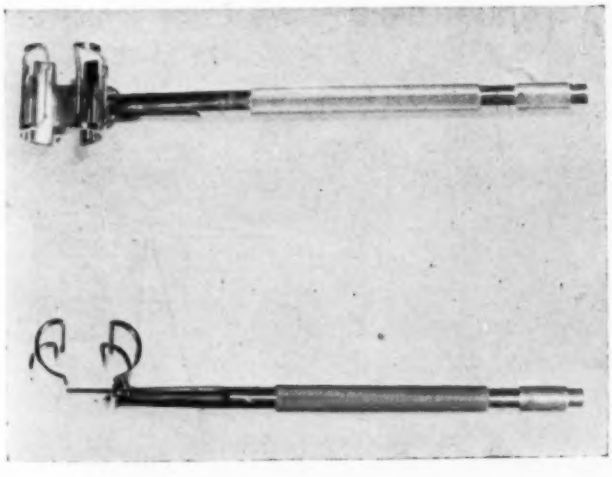


FIGURE 10: Smith-Potts aorta clamp.

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27 years with a red count of 9 million and we believe that she may have been too old for the operation.

CONCLUSION

In conclusion, I would emphasize that the Blalock-Taussig and Potts operations are of value only in cyanotic cases caused by deficient blood flow. The optimum age for the operation is probably from 5 to 9 years, although children as young as a few months and adults in the thirties have been done. One must remember that, in vascular surgery terms, the vessels are three times the chronological age; that is, an operation on the aorta of a person of twenty-five carries the operative risk that a gastrectomy or pneumonectomy or similar major procedure would carry in a person of seventy-five.

This is a field in which the disease is fascinating, the methods of diagnosis tedious, time-consuming and often expensive. Most of the patients apparently are impoverished. The operation is difficult, but stimulating. The successes are far from uniform but steadily improving. However, I know of nothing more gratifying to a surgeon than the feeling that his efforts may have contributed in altering the hopeless outlook of some of these little children to that of a functionally normal childhood.

CONCLUSION

Como conclusión desearía insistir en que las operaciones de Blalock-Taussig y Potts son de valor solamente en los casos cianóticos causados por deficiente corriente sanguínea. La edad óptima para la operación es probablemente de los 5 a los 9 años, aunque niños de algunos meses o adultos alrededor de los treinta años han sido operados. Debe uno recordar que por lo que se refiere a la cirugía vascular, los vasos son tres veces mayores que su edad cronológica; esto quiere decir que una operación en la aorta de una persona de 25 años, lleva consigo el riesgo de una gastrectomía o una neumonectomía u otro procedimiento similar en una persona de 75 años.

Este es un campo en el que la enfermedad es fascinante, los métodos de diagnóstico tediosos, prolongados y costosos. La mayoría de los enfermos están aparentemente empobrecidos. La operación es difícil pero estimulante. Los éxitos están lejos de ser uniformes pero constantemente mejorando. Sin embargo, no conozco nada más halagador para un cirujano, que la sensación de que sus esfuerzos pueden contribuír para alterar el desesperado futuro de algunos de estos niñitos trayéndolos a una infancia funcionalmente normal.

Discussion

DUANE CARR, M.D., F.C.C.P.
Memphis, Tennessee

Dr. Adams showed you a picture of the Bradshaw clamp which is indeed a valuable adjunct to coarctation operation. There is one precaution I suggest that you take before attempting to use it and that is that you either wrap the arms of the clamp with umbilical tape or slip a little tube of stockinet or something over it. We were much interested to watch the effect of the aortic pressure against the proximal bar of that clamp, and it was with some consternation that we noticed a gradual migration of that bar toward the line of incision. In our particular case we had plenty of length, it was an easy case to do and it gave us no trouble but I could easily see how working with a narrow margin and with no extra friction between the clamp and the aorta, it could easily slide itself off, because you can't hold an aorta tight shut with your fingers for any length of time. The pressure there is something terrific.

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A Modern Evaluation of Extrapleural Pneumonolysis in the Treatment of Pulmonary Tuberculosis with Special Reference to Methyl Methacrylate "Plombage" Review of 26 Cases*

HARRY E. WALKUP, M.D. and JAMES D. MURPHY, M.D., F.C.C.P.
Oteen, North Carolina

The term "extrapleural pneumonolysis" implies a freeing of the lung by the establishment of a cleavage plane between the parietal pleura and the endothoracic fascia in order to obtain an effective, as well as a selective collapse of an area of circumscribed tuberculosis in the apex of the lung. As a result of such a pleurolysis an extrapleural space is created which demands the insertion of some extraneous material for maintenance of the pulmonary collapse so produced.

It was the search for an optimum "filling" material that made this type of pneumonolysis one of the most interesting of all thoracic surgical procedures. In reviewing the literature one finds that this procedure waxed and waned in popularity since its introduction into the surgical literature by Tuffier in 1891, each decade introducing new "plombe" materials which, at the time of their introduction, were thought to represent the ideal extraneous material for maintenance of the extrapleural space. However, in each case the new burst of enthusiasm was short-lived and the popularity of the procedure would decline until the introduction of a new "plombe" material would lead to its revival.

In the spring of 1946 Wilson[1] presented his experimental work on methyl methacrylate (lucite) and first suggested its use as an extrapleural filling material. We accepted this idea with eagerness and after reviewing the literature and obtaining some lucite balls, performed our first extrapleural pneumonolysis with lucite pack in September of that same year. Our institution houses 1,000 tuberculous patients and the surgical unit at Oteen performs the thoracic surgical procedures for an adjoining hospital that houses some 500 patients with tuberculous disease. This makes 1,500

*From the Department of Medicine and Surgery, Veterans Administration, Oteen, North Carolina; published with permission of the Chief Medical Officer, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or conclusions drawn by the authors.

tuberculous patients from whom to select optimum cases for performance of this collapse procedure. It was from this number that the 26 patients receiving extrapleural pneumonolysis with lucite pack were selected. Each case was carefully studied with strict adherence to the indications established by surgeons who had reported earlier series of cases using such packing materials as paraffin, muscle graft, etc.

This paper is not being written in an effort to praise the procedure or to establish methyl methacrylate as the optimum filling material for the extrapleural space. We feel that our results show, unequivocally, that extrapleural pneumonolysis with lucite pack has but a narrow range of usefulness in the surgery of pulmonary tuberculosis, and that methyl methacrylate, although one of the best "plombe" materials introduced into the surgical field, is not divorced from the usual complications arising concomitant with the introduction of a foreign substance into the tissues of the human body. We would also like to place a word of warning for the enthusiastic novice experimenting with this type of procedure so that he will not use this operation injudiciously and with irretrievable violation of the indications for its use formulated over the past half century. The indications for an operation that has been tried by the world's foremost thoracic surgeons should not be changed on short notice because of the introduction of what only promises to be the long sought "optimum" extrapleural filling material.

In performing this operation we should select only those cases which offer reasonable assurance that some benefit may ensue from this collapse procedure and concentrate our efforts on these cases rather than on those that offer no reasonable hope of cure. To evaluate a new surgical procedure or a new modification of a preexisting established surgical procedure, one should select trial cases most judiciously so that a true evaluation can be made early in its evolution and thus prevent acrimonious criticism of the procedure before it has received a fair trial.

Indications

Tabulated below are a few of the indications for extrapleural pneumonolysis during the time when this procedure was being employed on our surgical service. Each indication is briefly discussed.

1) Apical cavities of small dimensions.
2) Inadequate respiratory reserve.
3) Bilateral disease.
4) Residual cavities under thoracoplastic collapse.

5) Extrapulmonary complications where the age and general condition of the patient contraindicate thoracoplasty.

When the internist informs us that he has a case for extrapleural pneumonolysis, we assume that the patient has a small apical cavity with dimensions of four centimeters or less, located at or above the level of the first anterior interspace. This cavity may be thick-walled, as proposed by Winternitz,[2] provided a large area of parenchymal induration does not surround it. On the other hand, it may be thin-walled, as proposed by the majority of workers in this field, provided its proximity to the parietal pleura does not make extrapleural dissection hazardous and provided no evidence of "blocked" or "tension" cavity exists.

With reference to inadequate respiratory reserve, it is an established fact that this procedure produces a selective collapse with the maximum preservation of normal pulmonary parenchyma and respiratory function, and in patients who have failed to respond to simpler collapse measures extrapleural pneumonolysis with plombage may offer them their only chance of cure. In many cases the respiratory reserve is increased following this procedure, a fact explained on the basis of better utilization of the inspired air following compression of a diseased segment of lung. This does not mean that every patient demonstrating a low vital capacity should be a candidate for the lucite operation, nor does it mean that we can promise the patient a cure even if his lesion is optimum for the procedure. It merely means that in a few selected cases the operation may be employed in an effort to close a small apical cavity. It is taken for granted that the patient is a good risk and that there is a chance for improvement or ultimate cure if the operation achieves its objective—closure of the cavity.

In bilateral pulmonary disease extrapleural pneumonolysis again finds a field of usefulness. In many instances a small apical lesion on one side can be closed by this procedure allowing a thoracoplasty on the contralateral side of greater involvement and indication. Of course, in these cases we must have an optimum apical lesion for the extrapleural procedure and our indications should not be altered because of the bilateral nature of the disease. Also this operation should not be employed if the lesser lesion can be controlled by one of our simple collapse measures.

In cases in which residual cavitation persists under an area of thoracoplastic collapse, our staff agrees with Dolley[3] who states:

"....in thoracoplasty we plan to carry on to cavity closure, not cavity wall approximation....It is very firmly our opinion that, unless cavity walls are actually brought together, healing does not take place."

Therefore, one might well assume that if a residual cavity is demonstrable in the first postoperative roentgenograms following the final stage of thoracoplasty, some type of supplemental operation will be necessary in order to close it. Although our results as tabulated in Table I show a high percentage of cavity closures (75 per cent) in this type of case, our department feels that lucite pneumonolysis is too hazardous a procedure to be used in these post-thoracoplasty cases. Since our experience with lucite pack for closure of such residual cavities, we have used the Eloesser[4] type of open cavernostomy and find that our results are much better with this latter procedure. Also, with the advent of streptomycin, we have been using lobectomy and pneumonectomy in selected cases, and again a far superior operation is at our disposal for such cases.

Whenever extrapulmonary complications or the age and general condition of the patient contraindicate thoracoplasty, extrapleural pneumonolysis with lucite pack may be employed to great advantage. Again, this operation should be used only in those lesions that offer a reasonable chance of closure. The advantage of lucite pneumonolysis in these poor-risk patients is that it can be performed in one stage, under local anesthesia, under which circumstances it is a relatively non-shocking operation. The additional factor of its selectivity with maximum preservation of non-diseased pulmonary parenchyma and its minimal interference with the normal expectoration mechanism make its use optimum in this type of patient.

Operative Technique

Both the anterior and posterior incisions have been employed in our series of cases. However, we prefer the posterior approach

TABLE I — Results in 22 Successfully Performed Extrapleural Pneumonolyses with Lucite Pack

Type of Pack	Patients	— CAVITY — Closed	Unclosed	— SPUTUM — Positive	Negative	Cases Negative Before and After Operation	Sputum Conversions
Primary	14	6 (42.9%)	8 (57.1%)	9 (64.3%)	5 (35.7%)	0	5 (35.7%)
Secondary	8	6 (75.0%)	2 (25.0%)	3 (37.5%)	5 (62.5%)	4 (50.0%)	1 (12.5%)
TOTAL	22	12 (54.5%)	10 (45.5%)	12 (54.5%)	10 (45.5%)	4 (18.2%)	6 (27.3%)

because it permits a more effective retaining in place of the permanent filling material by virtue of the overlying scapula and thick interscapular muscles. The anterior approach was used to advantage in an occasional case in our secondary series where planigrams revealed the residual cavity to be located in an anterior position.

For the posterior approach, a vertical incision about 12 centimeters in length is made through the skin, the trapezius and rhomboid muscles half way between the angles of the ribs and the spinous processes of the upper thoracic vertebrae. The scapula is then retracted laterally and the ribs are easily counted by inserting the hand under the scapula and locating the first rib. A portion of the third or fourth rib, approximately eight centimeters in length, is resected subperiosteally and a small incision made through its posterior periosteal bed. Blunt dissection is then employed by means of a small bronchial sponge on the end of a hemostat, until the extrapleural space is located and established sufficiently to admit the tip of the index finger. We then employ finger dissection to free the remainder of the extrapleural space. After the apex is freed, one often is unable to reach the mediastinal surface with blunt finger dissection and here a stick sponge is employed. This latter instrument is used under direct vision with a Cameron light which facilitates this step in the operation.

After the extrapleural space is created, the lucite balls are inserted and the wound closed in layers. We have found that closure of the intercostal, rhomboid and trapezius muscles plus approximation of the subcutaneous tissue and skin are sufficient to keep the pack in place.

In those cases in which the anterior approach was used, an oblique incision was made along the course of the second anterior rib and the pectoralis major muscle divided in the direction of its fibers. The insertion of the pectoralis minor muscle was detached with a raspatory as the second rib was removed. Entry into the extrapleural space was then effected as in the posterior approach. After insertion of the lucite pack, the severed portion of the pectoralis minor muscle was used to aid in closing the defect and the pectoralis major muscle, subcutaneous tissue and skin were approximated in layers.

Some workers[5,6] replace the resected rib and suture it *in situ* following plombage, to facilitate holding the pack in place. We tried this in several of our cases but found that it offered no advantage over the usual method of closure.

Results

Our series consists of 26 patients upon whom 30 stages of extrapleural pneumonolysis were performed. The first patient was operated upon in September 1946, and the twenty-sixth, or last patient in June 1947. Twenty-one of our patients are over eight months postoperative and in the remaining four a period of five months has elapsed since their last operation. Although it is realized that some adverse criticism may well arise from a premature presentation of this series, it is felt that many thoracic surgeons who are starting a similar series of cases may profit from our experience and substitute procedures that have proven more reliable through the production of unequivocal results over a period of years. In other words, a series of cases presenting poor results over a relatively short period of 14 months is probably of more value to the reader than a series of good results studied over a period of years, especially if the former procedure is in vogue and being tried in all parts of the country.

In our series the average duration of disease was four and one-half years, with ranges of from one to 24 years respectively. Seventeen of the 26 patients had bilateral disease which varied in character from moderate tuberculous apical infiltration to actual cavitation in the contralateral lung. The average age of the 26 patients was 40.8 years; the youngest was 20 years old, the oldest 58. Four patients had evidence of endobronchial disease which responded to bronchoscopic cauterization with a 30 per cent solution of silver nitrate.

In four of our 26 patients extrapleural cleavage was attempted but was unsuccessful. In three, where cleavage was attempted under an area of thoracoplastic collapse, marked peripleuritis rendered dissection difficult and resulted in entry into the pleural space. Two of these were approached through an anterior incision and one through the usual posterior route. In the fourth, which was performed as an initial major collapse procedure through a posterior approach, a lack of pleural symphysis was encountered and a rupture through the thin parietal pleura necessitated abandonment of the dissection.

We shall now discuss results in the remaining 22 patients in whom extrapleural pneumonolysis was successful and allowed the insertion of a methyl methacrylate (lucite) pack in the space so created (See Table I).

In 14 cases the packs were primary, no other major collapse procedures having been attempted. In eight the packs were secondary, or packs performed under an area of thoracoplastic

collapse. Throughout the remainder of the discussion, these will be referred to as primary and secondary packs, respectively.

Our final results (Table I) show that 12 of our patients closed their cavity and that six actually converted their sputum after operation. In the 14 cases represented under the primary pack sub-group, it was found that six attained cavity closure and five showed sputum conversion. Of the remaining eight cases, representing the secondary packs, six had closed their cavities but only one demonstrated actual conversion of his sputum from positive to negative. It should be emphasized, however, that the low percentage of sputum conversions reported in our latter group did not include the four that were negative prior to, and after operation and in whom the pack was inserted merely to obliterate a residual cavity.

It was mentioned that 17 of our original 26 patients had contralateral disease. However, in the results summated from our 22 successful cases, only one of the nine included in our primary group, and one of the three in the secondary series failed to convert their sputum because of contralateral disease. The re-

TABLE II

Fate of Cavities as to Size and Type in Primary Series

Size cm.	Type of Cavity	— CAVITY — Closed	Unclosed	— SPUTUM — Positive	Negative
0 - 0.5	Pinner II				
	Pinner III	1	2	2	1
0.5 - 1.0	Pinner II	2		1	1
	Pinner III				
1.0 - 1.5	Pinner II	1	1	1	1
	Pinner III				
1.5 - 2.0	Pinner II				
	Pinner III		2	2	
2.0 - 2.5	Pinner II				
	Pinner III	1	1	1	1
2.5 - 3.0	Pinner II	1			1
	Pinner III				
3.0 - 3.5	Pinner II		1	1	
	Pinner III				
3.5 - 4.0	Pinner II		1	1	
	Pinner III				

maining ten demonstrated open cavities under the area of lucite pack which gave sufficient reason for the positive sputum.

The number of lucite balls employed varied from 12 to 59 in the primary group, and from four to 18 in the secondary series. The average number of balls inserted per patient was 27 in the former and 12 in the latter.

Primary packs were placed through posterior incisions by removing sections of the third or fourth rib in 13 cases, and through an anterior incision with removal of a section of the second rib, in one case. In two of these cases supplemental packs were added at another optration, in an effort to close a residual cavity under the initial lucite pack. Both supplemental packs were inserted posteriorly, the initial pack having been introduced anteriorly in one and posteriorly in the other. In neither of these patients receiving supplemental pack under our primary series was cavity closure achieved.

In eight of our secondary pack series the initial pack was inserted through a posterior approach. The regenerated ribs overlying the cavitary area were removed thus affording access to

TABLE III

Fate of Cavities as to Size and Type in Secondary Series

Size cm.	Type of Cavity	— CAVITY — Closed	Unclosed	— SPUTUM — Positive	Negative
0 - 0.5	Pinner II				
	Pinner III				
0.5 - 1.0	Pinner II				
	Pinner III				
1.0 - 1.5	Pinner II	1	1		2
	Pinner III		1	1	
1.5 - 2.0	Pinner II	2		1	1
	Pinner III				
2.0 - 2.5	Pinner II	1			1
	Pinner III				
2.5 - 3.0	Pinner II				
	Pinner III				
3.0 - 3.5	Pinner II	1		1	
	Pinner III				
3.5 - 4.0	Pinner II	1			1
	Pinner III				

the extrapleural space. In two of these, in which postoperative planigrams revealed residual cavitation following the initial pack, a supplemental pack was inserted through an anterior approach with removal of a portion of the second rib. Cavity closure was obtained in both, and sputum conversion was accomplished in one. Contralateral disease explained the failure of conversion in the other case.

We have employed Pinner's[7] classification in grouping the types of cavities:

Type I Cavities without established walls.
Type II Cavities with young fibrous walls.
Type III Cavities with old fibrotic walls.

Of our combined successful lucite pack cases,—that is, both primary and secondary, 14 had Pinner Type II cavity and eight Pinner Type III (see Tables II and III). No case with Pinner Type I cavity would be suitable for this type of collapse procedure and hence, it will be omitted from this discussion. The diameters of these cavities varied from 0.5 cm. to 4 cm., the average size being two centimeters in the 22 cases. In each patient included under the primary pack group, the cavity was located above the level of the first anterior interspace and in the majority of cases it was at the level of, or above the first anterior rib.

Of the seven Type II cavities in the primary group, three converted their sputum and four attained cavity closure. In the secondary group of seven Type II cavities, one patient converted his sputum (four of these patients were negative prior to and after operation), and six obtained cavity closure.

Of the seven patients having Type III cavities in the primary group, two closed their cavities and converted their sputum. The other five remained persistently positive on direct smear and their cavities failed to close. Only one of our secondary group had a Type III cavity. This remained open and his sputum failed to convert. In the secondary series the prethroacoplasty roentgenogram determined the type of cavity rather than the planigraphic study of the collapse area after thoracoplasty. We felt justified in selecting the prethoracoplasty film in that our cases are kept on the surgical ward until cavity closure and conversion are achieved. Hence, if a residual cavity was located on planigraphic study following thoracoplasty, only an interval of from four to six weeks would have elapsed between his last stage of thoracoplasty and insertion of the lucite pack. We felt relatively certain that the nature of the cavity would change but little, so far as its classification into Pinner's types is concerned, during this period of time, despite the distortion of its original configuration by the imposed thoracoplastic collapse.

Complications of Extrapleural Pneumonolysis with Plombage

We know of no operation in thoracic surgery that offers so wide a variety of complications, both early and late, as does extrapleural pneumonolysis with plombage. Throughout the literature long lists of complications were mentioned and these were altered but little by the introduction of the new plombe materials during the evolution of the procedure. In the following paragraphs we shall discuss only those complications which occurred in the 26 cases in which extrapleural pneumonolysis was attempted or performed.

In our series of extrapleural pneumonolyses with lucite plombage the operative complications were minimal but the postoperative complications were many. In four cases perforation of the pleura occurred. Three of these were in our secondary series, performed under an area of thoracoplastic collapse, and the marked peripleuritis encountered was responsible for the ultimate rupture into the pleural space. In the other case, a member of the primary group which includes those cases in which this operation constituted the initial major collapse procedure, a thin parietal pleura plus the lack of pleural symphysis over the diseased area permitted rupture into the pleural space.

In two of our cases, both of which were included in the secondary series, a mild hemorrhage occurred during dissection. In each of these the bleeding was controlled after inserting a warm saline pack over the area for a few minutes. In no instance was hemorrhage a major problem in the 30 operations of pleurolysis.

Only one of our patients developed an effusion around the lucite pack. This was diagnosed on the fourth postoperative day at which time 200 cc. of serous fluid was aspirated from the extrapleural space. No further accumulation of fluid occurred following this single aspiration.

One patient developed dyspnea. In this instance 59 balls were placed in the extrapleural space with the production of so extensive a collapse that the patient's respiratory reserve was embarrassed. In this patient the lucite pack was removed on the fourth postoperative day and an extrapleural pneumothorax was substituted. In only one other case was so massive an extrapleural pack employed. No respiratory embarrassment followed the insertion of the 50 balls in this patient, but six weeks after operation an erosion of the pack into the cavity necessitated its removal. A broncho-cavitary-extrapleural fistula persists having acquired a cutaneous component upon removal of the pack.

In another patient in which 31 lucite balls were used to compress an apical cavity, rupture through into the cavity occurred

seven months after the initial operation which resulted in abscess formation in the lower portion of the extrapleural space. Again, a bronchocutaneous communication occurred following removal of the pack.

We did not encounter a single superficial wound infection; however, one patient in the secondary series developed a pyogenic empyema five days after insertion of the pack. The latter was removed and the extrapleural space obliterated itself over a period of two months by third-intention healing.

Mild hemoptysis occurred in three patients on the operative or first postoperative day. Stocklin[8] mentioned the occurrence of mild hemoptysis in such cases and attributed it to cavity wall approximation with a rubbing together of the opposing walls.

In one case in the secondary series, a lucite ball migrated to the cervical area causing pressure symptoms referable to brachial plexus and subclavian artery compression. Figure 12 shows this ball in the cervical area. Later it was removed through a cervical incision with subsequent alleviation of symptoms. In another case in which a primary pack with subsequent supplemental pack was inserted through an anterior incision, the cavity failed to close and removal of the pack was performed four months after the supplemental operation. On entering the extrapleural space we found that five lucite balls had eroded into the mediastinum and were found around the pericardium and great vessels.

In another of our primary group of cases in which a supple-

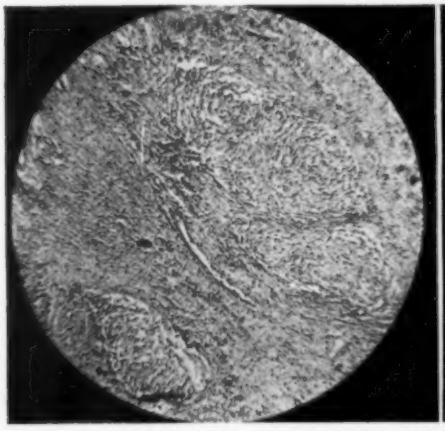

FIGURE 1

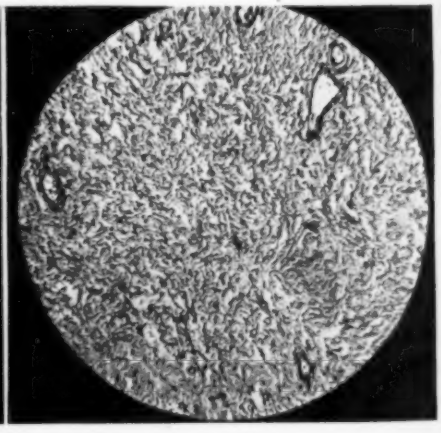

FIGURE 2

Fig. 1, Case 2: Photomicrograph of dense collagenous tissues surrounding lucite balls showing fibrosis and foreign body reaction. The parts are hyperemic and round cell infiltration is noted. Scattered and grouped granulomata are demonstrable. (Hematoxylin and eosin stain).—*Fig. 2, Case 1:* Photomicrograph of fibrous tissue surrounding lucite balls. Groups of wide blood capillaries and an occasional small accumulation of round cells, plasma cells, and histiocytes are demonstrable throughout this fibrous matrix. (Hematoxylin and eosin stain).

mental pack had been employed, an elective removal of the pack with concomitant first-stage posterolateral thoracoplasty was undertaken. Two days later the patient developed a broncho-cavitary-extrapleural communication which necessitated reopening of the extrapleural space to secure adequate drainage of the area. The wound is slowly healing by third intention but the broncho-cutaneous communication persists.

As to methyl methacrylate (lucite), we have found that this substance is far from being the optimum filling material. We have encountered such complications as erosion through the cavity wall both early and late, empyema of the extrapleural space following its introduction, and migration of the lucite balls into both mediastinum and cervical region. In one instance in which the lucite pack was removed and microscopic examination made of the fibrous matrix surrounding the pack, an occasional translucent particle about 20 to 30 micra in diameter and suspicious of lucite was seen in the sections. It is our opinion that through friction minute particles were rubbed off and their presence in the tissues caused a foreign body reaction (Fig. 1). No acid-fast bacilli were demonstrable in the sections. In the other cases no granulomata were noted, the microscopic picture revealing fibrous tissue containing lymphocytes, histiocytes and plasma cells (Fig. 2). This was the typical picture found in the fibrous tissue matrix surrounding the lucite pack.

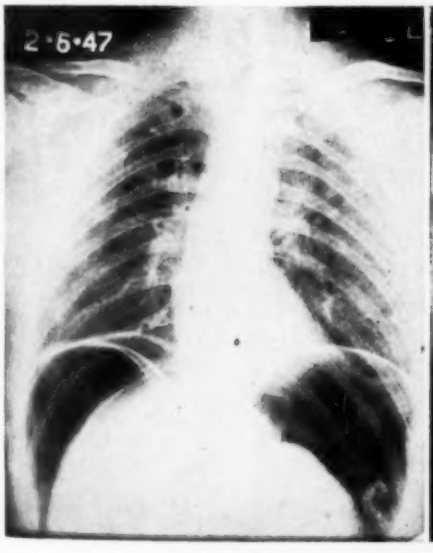

FIGURE 3

FIGURE 4

Fig. 3, Case 1: Initial roentgenogram demonstrating a 2.0-centimeter Pinner Type III cavity in right apical region.—*Fig. 4, Case 1:* Planigram demonstrating area of residual cavitation under lucite pack.

In concluding our list of complications, we should like to emphasize the fact that out of our original 22 cases successfully performed, five or 22.7 per cent have had the packs removed and three additional patients are to have removal of the packs within the next month. This will make a total of eight, or 36.3 per cent removal. Of these, three or 13.6 per cent have had the pack removed as an emergency procedure because of complicating factors. Another patient had a lucite ball removed from the cervical area subsequent to its migration into this region.

In the light of these results we hesitate to advise the use of lucite pneumonolysis even for those cases which present ideal indications. When the facts are faced, it is apparent that the extrapleural operation is available for a class of patients who are unsuitable candidates for thoracoplasty, and we cannot expect this type of patients to survive the serious complications and accompanying high morbidity that are inevitable in a large percentage of these cases.

After evaluating the final results as to cavity closure and sputum conversion, and including our complications which are far too numerous, we feel that extrapleural pneumonolysis with plombage leaves much to be desired, irrespective of the type of plombe employed, and are convinced that it has not withstood the test of careful scientific investigation over the past half-century.

FIGURE 5

FIGURE 6

Fig. 5, Case 2: Initial roentgenogram demonstrating a 4.0-centimeter Pinner Type II cavity in the left apical region.—*Fig. 6, Case 2:* Planigram of collapse area under lucite pack after addition of a supplemental pack. Large ballooned cavity is still demonstrable.

Exemplary Cases

Five exemplary cases have been selected from our lucite pneumonolysis series which demonstrate some of the results and complications accompanying this procedure. These case reports are presented below with brief histories and illustrations.

Case 1: A.P., age 50. Duration of disease, three years. Right extrapleural pneumonolysis was performed February 7, 1947 through a posterior incision; 25 lucite balls were inserted in an effort to close a small fibrocavernous Pinner Type III lesion, 2.0 centimeters in diameter, located above the level of the first anterior rib (Fig. 3). This operation and a supplemental operation with the addition of eight more lucite balls failed to close the cavity (Fig. 4). Upon subsequent removal of this pack, five balls were found to have eroded through into the mediastinum and were located around the great vessels and the pericardium.

Case 2: W.A., age 22. Duration of disease, three years. Left extrapleural pneumonolysis was performed January 2, 1947 through a posterior approach; 13 lucite balls were inserted in an effort to close a four-centimeter Pinner Type II cavity at the level of the first anterior rib (Fig. 5). Following this procedure a residual cavity was demonstrated and a supplemental pack was inserted comprising 12 lucite balls. Postoperative planigrams (Fig. 6) revealed the presence of a large tension type of cavity under the area of lucite pack. In later serial roentgenograms this cavity would actually increase and decrease in size from time to time.

This case demonstrates the futility of attempting to close a tension type of cavity with this procedure.

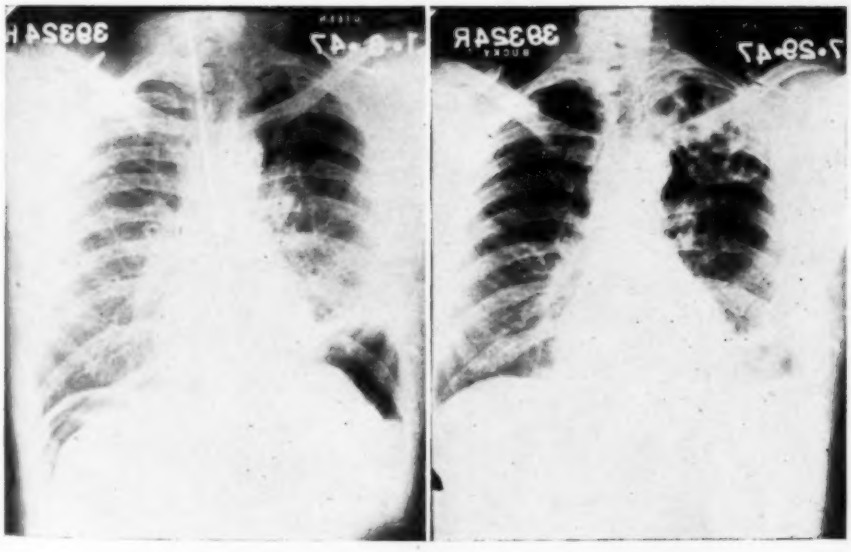

FIGURE 7 FIGURE 8

Fig. 7, Case 3: Roentgenogram demonstrating 1.0-centimeter Pinner Type III cavity in apex of left lung.—*Fig. 8, Case 3:* Film demonstrates collapse produced by insertion of 15 lucite balls in left extrapleural space. No residual cavitation is demonstrable.

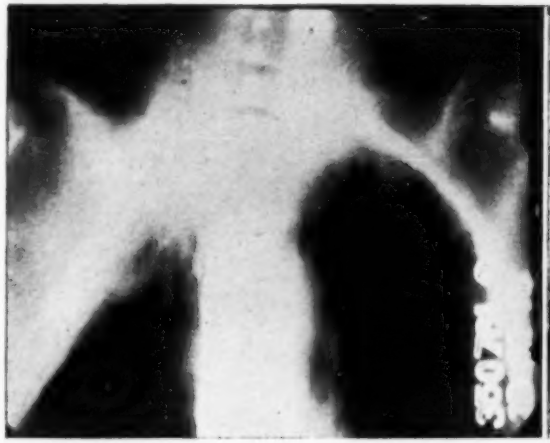

FIGURE 9

FIGURE 10

FIGURE 11

Fig. 9, Case 4: Bilateral planigram demonstrating a small 0.5-centimeter Pinner Type III cavity in the apex of left lung.—*Fig. 10, Case 4:* Planigram of area under left lucite pack showing small 0.5-centimeter residual cavity.—*Fig. 11, Case 5:* Bilateral planigram demonstrating residual cavity in area of left thoracoplastic collapse. Fibrocavernous lesion is seen in the contralateral apical area.

Case 3: C.R., age 36. Duration of disease, one year. A left extrapleural pneumonolysis was performed through a posterior approach for closure of a 1.0-centimeter Pinner Type III cavity in the left apex, above the level of the first anterior rib (Fig. 7).

In this instance insertion of 15 lucite balls in the extrapleural space effected closure of the cavity (Fig. 8).

Case 4: C.C., age 50. Duration of disease, five years. Patient had a right, two-stage, six-rib, posterolateral thoracoplasty in May, 1946. A postoperative bilateral planigram revealed a small 0.5-centimeter Pinner Type III cavity in the apex of the left lung above the level of the first anterior rib (Fig. 9). Through a posterior incision 19 lucite balls were placed in the left extrapleural space. Planigrams taken after this procedure revealed a small residual cavity under the area of lucite pack (Fig. 10).

Case 5: J.J., age 55. Duration of disease, eight years. Previous therapy consisted of a left, three-stage, seven-rib, posterolateral thoracoplasty in September, 1946. Following this operation planigrams revealed a large residual cavity under the thoracoplastic collapse (Fig. 11). On March 17, 1947 a left, extrapleural pneumonolysis was performed through a posterior incision and nine lucite balls inserted. The patient later developed symptoms referable to brachial plexus and subclavian artery compression. Roentgenograms revealed the presence of a lucite ball in the cervical region adjacent to the area occupied by these structures (Fig. 12). Removal of this ball through a cervical incision secured alleviation of symptoms. Figure 13 shows the absence of the cervical lucite ball with closure of the cavity under the lucite pack.

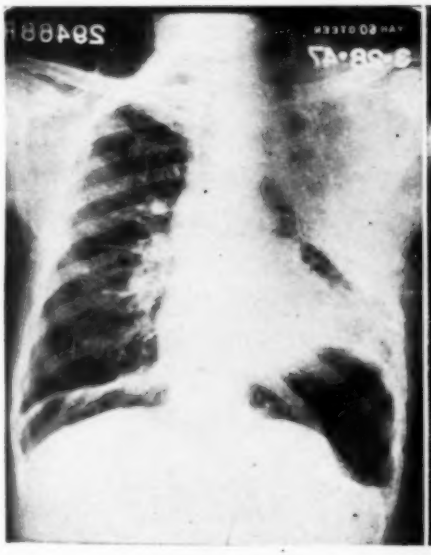

FIGURE 12

FIGURE 13

Fig. 12, Case 5: Roentgenogram following insertion of nine lucite balls in left extrapleural space over residual cavitary area. One ball migrated into the neck and caused symptoms referable to brachial plexus and subclavian artery compression.—*Fig. 13, Case 5:* Planigram showing area of lucite pneumonolysis following removal of lucite ball from cervical area. No residual cavitation is demonstrable in the collapsed area.

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SUMMARY

1) The indications for extrapleural pneumonolysis with lucite plombage are briefly presented and discussed.

2) The operative technique is described.

3) Results and complications in 26 patients upon whom 30 stages of extrapleural pneumonolysis were performed are reviewed. The low percentage of cavity closure and sputum conversions plus the numerous complicating factors occurring with this procedure caused us to abandon its use on our thoracic surgical service.

4) Five cases are reported with illustrations to demonstrate some of the results and complications following the use of this operation.

RESUMEN

1) Se presentan y discuten suscintamente las indicaciones para la neumonolisis extrapleural y plombaje con *lucite*.

2) Se describe la técnica operatoria.

3) Se revisan los resultados y complicaciones en 26 pacientes sometidos a 30 tiempos de neumonolisis extrapleural. El bajo porcentaje de cierre de cavernas y conversión de esputos, además de las numerosas complicaciones que acompañan a este procedimiento, nos obligaron a abandonar su empleo en nuestro servicio quirúrgico de tórax.

4) Se refieren cinco casos ilustrados para demostrar algunos de los resultados y complicaciones subsiguientes al empleo de esta operación.

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Systemic Blastomycosis*

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Introduction

Blastomycosis is a disease caused by the organism Blastomyces dermatitidis. It is not rare yet is by no means common, and case reports are not numerous. For this reason, further case presentation is justifiable for whatever additional light it may shed upon the disease. Martin and Smith,[1] who reviewed the literature up to 1939, considered only 80 (23 per cent) of the 347 reported cases as proved. They added 13 new cases of their own. In 1942, Baker[2] analyzed the tissue in 23 cases of human blastomycosis occurring in a 10 year period. Ten of these cases were of the generalized type; some had been previously reported.

Jacobsen and Dockerty[3] reported on four cases of blastomycosis of the epididymis and stated that they represent only a fraction of the total number of patients with proved blastomycosis; from 1910 through 1942, 62 patients in all were seen; 56 were males and 6 females. Of the males, 12 had systemic blastomycosis and 44 had the cutaneous type. No attempt is made here to bring the total number of reported cases up to date, and the literature has already been ably reviewed.[1,4]

At Muirdale Sanatorium the following study was made from December 1934 to August 1948. During that time 11 cases of human systemic blastomycosis came under our observation. All entered as presumable cases of pulmonary tuberculosis; two had both diseases.

Mycology

Gilchrist, in 1894, discovered the yeast-like organism in a section of diseased skin and named it Blastomyces dermatitidis. It is round or oval, varies from 10 to 15 microns in diameter, has a highly refractive, double-contoured border, and may be seen singly or in clusters. Budding forms are practically always present. The organisms will grow in two to four days, although in some

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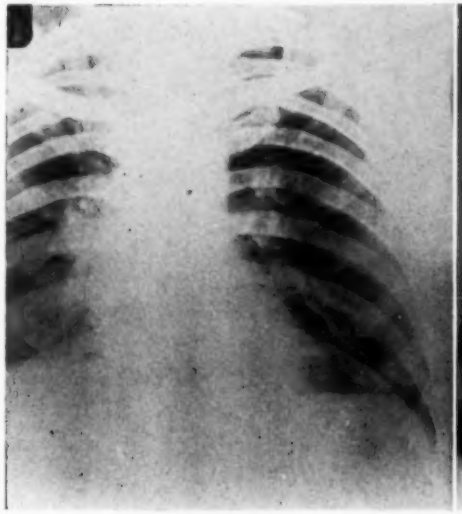

FIGURE 1

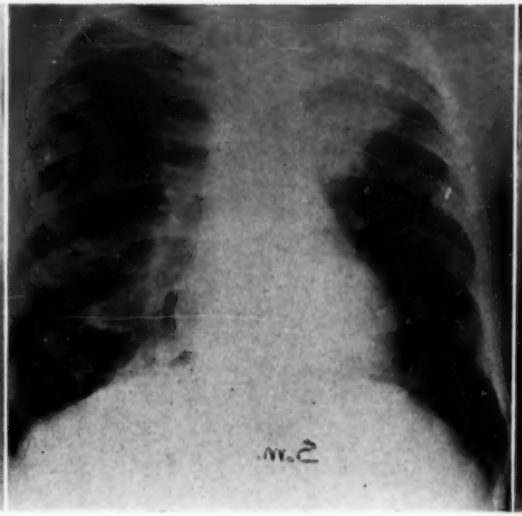

FIGURE 2

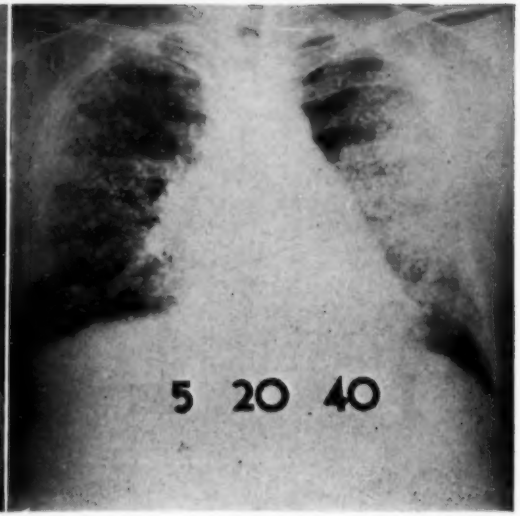

FIGURE 3

Fig. 1, Case 1: T.D., white, male, 41 years old, road construction worker. Respiratory symptoms six months prior to admission. Later he developed subcutaneous abscesses on his right hand, wrists, and left ankle. Died January 1936, just 18 months after the onset of symptoms. Postmortem examination revealed generalized blastomycosis involving the lungs, liver, kidneys, and spleen.—*Fig. 2, Case 2:* S.M., white, male, age 43, crane operator. Respiratory symptoms of two months duration and deep non-painful subcutaneous abscess in the left gluteal area and the left arm. Bronchoscopic examination revealed nearly a complete occlusion of the left main bronchus. Pus from one of the abscesses revealed B. dermatitidis, but guinea pig inoculation was negative for blastomycosis and tuberculosis. Treatment consisted of saturated solution of potassium iodide by mouth, 40 mm. t.i.d. The patient died from terminal meningitis on March 10, 1937, four months following the onset of symptoms. Postmortem examination revealed a generalized blastomycosis with meningeal involvement.—*Fig. 3, Case 3:* F.P., white, male, age 47. One month prior to admission he became sick with fever, chills, cough, expectoration and hemoptysis. Sputum examination revealed tubercle bacilli and B. Dermatitidis, both of which were verified on culture. Death occurred one month later. Treatment was palliative. No iodides were given.

cases it may take two weeks, on Sabouraud's agar medium or dextrose blood agar. Differentiation from other fungi, particularly Coccidioides immitis and Torula histolytica, may require a trained bacteriologist or mycologist.

Mode of Infection

The sources of the infection and the method of its transmission remain an unsolved problem.[5] As far as known, direct transmission from man to man is rare. The portal of entry is thought to be by direct inoculation in the primary cutaneous disease and by respiratory tract in the systemic type.

The organism is widespread in nature, and individuals of practically all ages have been infected; the ratio between male and female is reported as 9 to 1 (nine of our 11 cases were males). There does not appear to be any occupational relationship to the disease, but it is reported as more common among poor people.

Pathology

The microscopic picture is somewhat like tuberculosis, and blastomycosis is occasionally mistaken for tuberculosis, as in our case 2. Medlar[6] says the only way to tell the difference between the two diseases is to find the organism. Baker[2] believes a differentiation can be made on the histological basis and indicates that human blastomycosis is primarily pyogenic with predominance of polymorphonuclear neutrophiles.

The blood picture does not present unusual findings. Most of our cases revealed a leucocytosis with an increase in neutrophiles, and all had a rapid sedimentation rate of the erythrocytes.

Clinical Manifestations

The disease manifests itself in two forms: the cutaneous which is either primary or secondary and the systemic in which any organ of the body can be involved. In the primary cutaneous type, papular and pustular lesions usually appear on the face, neck or the extremities. Unless there is extensive involvement, the patient is not sick. Necropsy records[5] disclose that 95 per cent of the systemic cases present some degree of pulmonary involvement. All of our cases were of the systemic variety and eight developed secondary skin lesions in the form of subcutaneous abscesses. All had respiratory symptoms, characterized by cough, expectoration, hemoptysis and chest pain; they had loss of appetite and weight, fever and chills. Some patients have a paucity of symptoms. Occasionally a case may show moderately severe toxicity with small involvement.

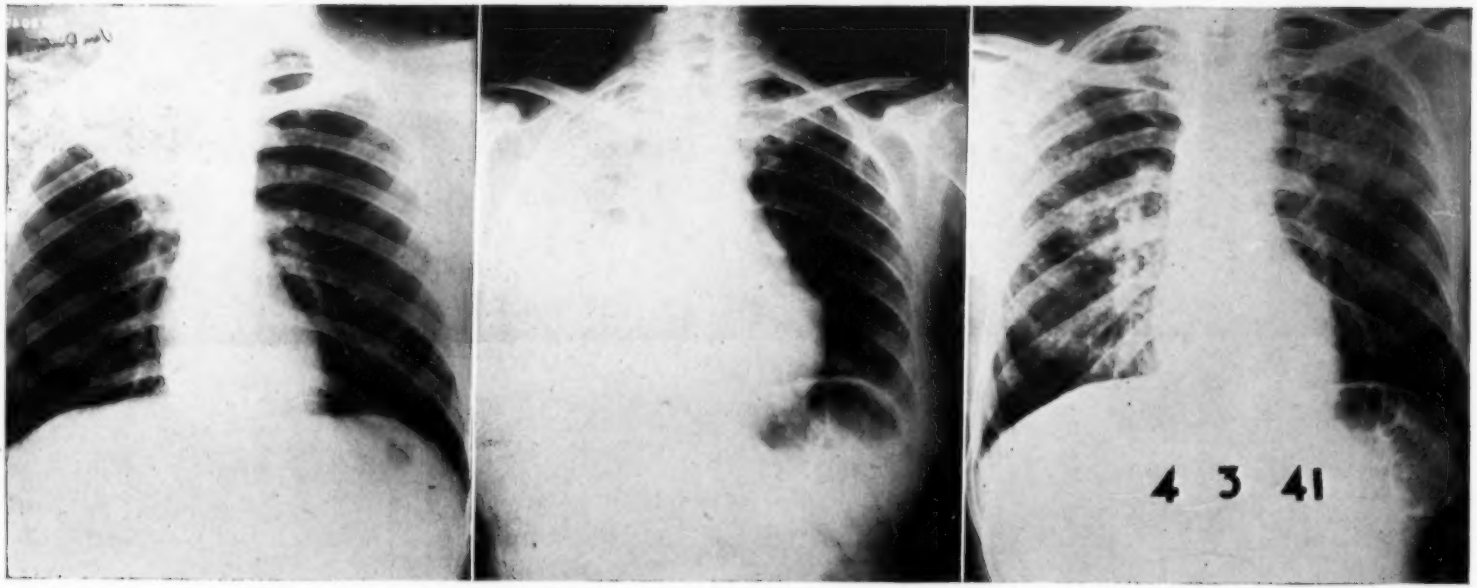

FIGURE 4 FIGURE 5 FIGURE 6

Fig. 4, Case 4: E.V., white, male, age 29. His respiratory symptoms were of six weeks' duration. Bronchoscopic examination revealed a moderate narrowing of the right upper lobe bronchus. Blastomyces were found in the sputum on wet smear, and cultures were positive for this organism.—*Fig. 5, Case 5:* R.R., white, female, age 36, bookkeeper. Ten weeks before admission she developed "stomach flu" and one week later pain in the lower right chest. The day before admission to Muirdale 500 cc. of clear fluid were aspirated from the right pleural cavity. This fluid, inoculated into a guinea pig, was negative for tuberculosis. Her symptoms were loss of appetite, loss of weight, right chest pain, fever and chills. Bronchoscopic examination revealed a bulging of the medial bronchial wall at the level of the right middle and lower lobe orifice. A second chest aspiration revealed pus, and blastomyces were present on wet smear. This was confirmed by culture. The treatment consisted of saturated solution of potassium iodide, reaching a dose of 90 mm., t.i.d. The patient died nine months from onset of symptoms. Postmortem examination revealed generalized blastomycosis and two cavities were found in the right lung, measuring 7 cm. and 4 cm. in diameter.—*Fig. 6, Case 6: J.D.Mc.*, colored, male, age 51, molder (10 years). In January 1941 he developed respiratory symptoms. His sputum was positive for tubercle bacilli. Two weeks after admission he complained of a toothache and pain over the left jaw. Examination revealed a deep-seated, non-painful nodule, about the size of a navy bean, over the left masseter area. Over a considerable period of time the abscess gradually increased in size and became fluctuant. Four more deep-seated slightly painful abscesses developed, two each over the right and left scapulae. Pus aspirated from these abscesses on June 11 revealed blastomyces that were positive on all cultures. Treatment consisted of saturated solution of potassium iodide; the maximum dose being 24 mm., t.i.d. The abscesses were frequently aspirated, were finally broken down and discharged small amounts of pus through the needle puncture-wound. The abscesses were irrigated with tincture of iodine and complete healing occurred in about four weeks.

Diagnosis

Skin tests and complement fixation reaction are advantageous and should be used in obscure cases.[1] The diagnosis, however, is established by the demonstration of the B. dermatitidis which may be recovered from various body secretions or may be demonstrable in biopsy. Culture methods of diagnosis,[2] even without sections showing characteristic tissue response, have proved to be reasonably accurate since B. dermatitidis has not been shown to be a common secondary invader of human lesions or exudates. Mice are recommended for animal inoculation since they are the most susceptible laboratory animals.

Roentgenogram

There is nothing characteristic in the roentgenologic appearance, and we agree with Reeves[7] that lung lesions are variable from dense pneumonic masses to miliary distribution. Five of our cases had upper lobe consolidations, and one of them developed a typical bronchogenic spread to the opposite side. It has been stated[8] that most cases show dense masses extending out from the hilum. Cavities[1] are reported to be uncommon and not over 1 cm. in diameter. Capdehourate and his associates[9] report one case with a large pulmonary cavity.

Treatment

A number of drugs have been used, including the arsenicals, colloidal copper and gold, thymol, sulfonamides, ether,[4,10] penicillin, and many others.

The sulfonamides have not proved very beneficial, although Albert[11] reports a case of extensive cutaneous blastomycosis that did not respond to potassium iodide, but was cured by sulfathiazole and sulfapyridine. Noojin and Callaway,[12] in vitro experiment, tried seven of the sulfonamides, and none was effective at levels as high as 10 mg. per 100 cc. Sulfadiazine, the most efficient drug used, was not decidedly fungistatic until a concentration of 125 mg. per 100 cc. was reached. They suggest the use of sulfanilamide for topical therapy of cutaneous blastomycosis. Frank and Taylor[13] reported on a case of cutaneous blastomycosis complicated by meningitis where they used iodides, sulfonamides and penicillin, but the patient died. Penicillin is contraindicated in blastomycosis.[14,15] Meyer and Ordol[17] used B. dermatitidis in vitro experiment and showed that streptothricin and gliotoxin were fungistatic while streptomycin and penicillin were not. The organism was highly resistant to streptomycin.

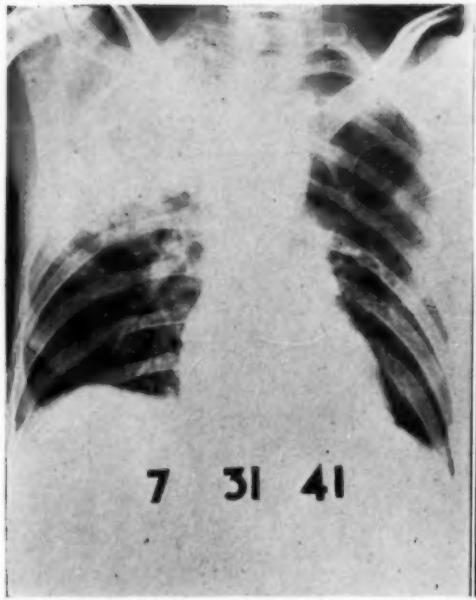

FIGURE 7A

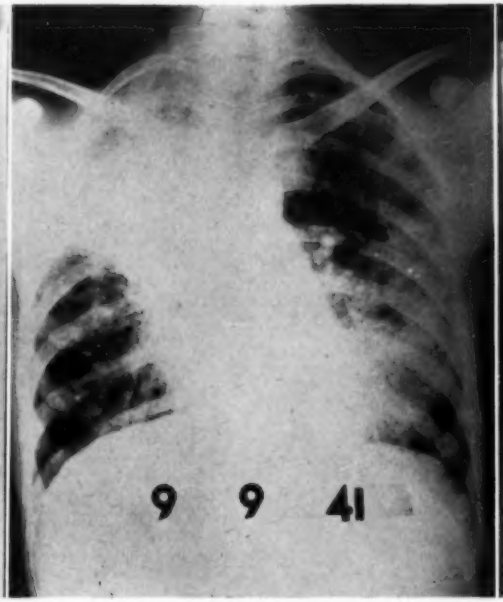

FIGURE 7B

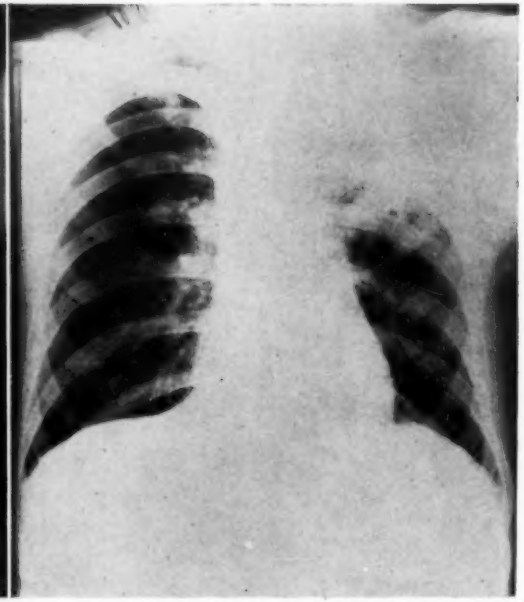

FIGURE 8

Fig. 7A, Case 7: H.D., white, male, age 26, garage mechanic. He entered Muirdale with marked respiratory symptoms, and with a past history of repeated chest colds for 18 months. His general condition was poor. Blastomyces were recovered from the sputum and from one small abscess on his left forearm. No iodides were given. A postmortem examination (performed 20 months from onset of symptoms and seven weeks after admission to Muirdale) revealed generalized blastomycosis with a 5 cm. cavity in the right apex.—*Fig. 7B, Case 7:* Bronchogenic spread to the left base.—*Fig. 8, Case 8:* D.G., white, male, age 39, office manager. The patient was well until six weeks prior to admission when he developed cough, expectoration, blood streaked sputum and fatigue. Sputum examination at Muirdale were negative for tubercle bacilli but revealed B. dermatitidis. The treatment consisted of sulfadiazine which was started February 7 and continued for 17 days. The blood levels reached a maximum of 10 mg. per 100 cc. of blood. There was no apparent result with this drug and saturated solution of potassium iodide was started. The maximum dose was 50 mm., t.i.d. and the response was gratifying.

The most commonly used drugs are the iodides, alone or in combination with various other agents. According to Martin and Smith[16] iodides may aggravate the condition, particularly when the patient is highly allergic to the fungus. Therefore, by means of skin testing they ascertain the degree of sensitivity and reduce it by vaccine therapy, if necessary, before starting the iodides. They feel that this procedure is extremely important.

Prognosis

The prognosis is good in the primary cutaneous types, but a 90 per cent mortality is reported in the systemic type.

Discussion

In systemic blastomycosis it is not difficult to understand the erroneous diagnosis of pulmonary tuberculosis which is so frequently made. Even the histologic pictures of the two diseases are similar. An accurate diagnosis is established when the organism is recovered. Cultural methods are reliable, and in our experience animal inoculation was not helpful. Mice were inoculated with cultural material from cases 3 and 4, and pleural fluid from case 5 was inoculated into a guinea pig, but blastomycosis did not develop in any of the animals. In our 11 cases, there do not appear to be any occupational, racial, or economic factors contributing to the disease. Two of our cases were Negroes. Twenty-eight per cent of other reported cases were Negroes,[1] but this high percentage may have been due to the population makeup of particular areas.

Pulmonary involvement is practically always present, but it could not be proved conclusively by roentgenograms in cases 3 and 4 where the presence of silicosis and tuberculosis complicated the picture. The supposed characteristic of hilar involvement was present in cases 1 and 9. In case 5 the lung field was obscured by pleurisy with effusion, but the bronchoscopic examination indicated a mediastinal mass. Large pulmonary cavities are not common, but cases 5 and 7 had cavities measuring 5 cm. and 7 cm., respectively, discovered on postmortem examination.

In spite of the report[11] that sulfathiazole and sulfapyridine were more effective than iodides, iodides in large doses were apparently effective in four of our cases. These patients have been observed from three to eight years following the onset of disease, and there has been no evidence of recurrence. We have given large doses of potassium iodide to points of intolerance and recommend that the drug be continued for a long period of time well beyond the stage of apparent cure.

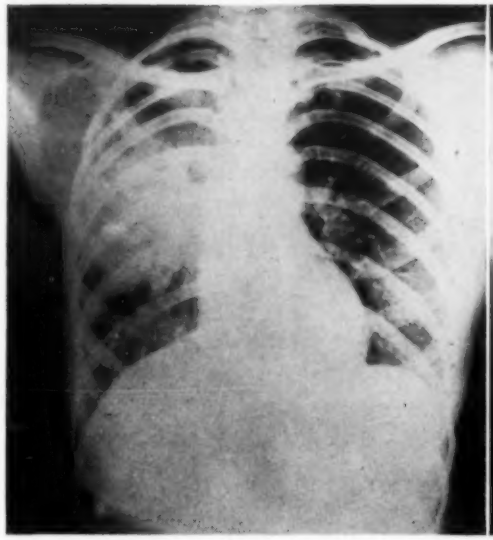

FIGURE 9

FIGURE 10

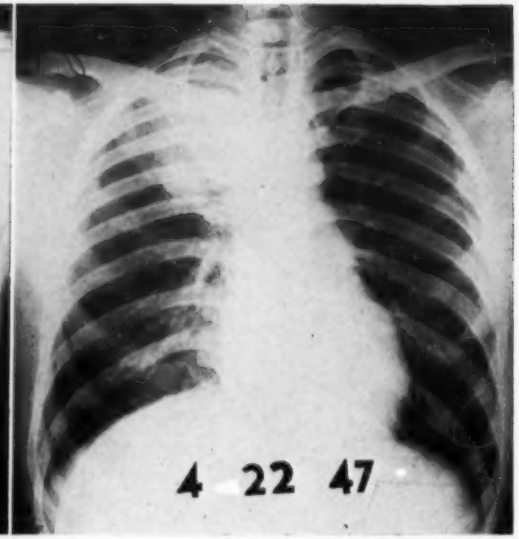

FIGURE 11

Fig. 9, Case 9: M.J., colored, female, age 38, housewife. She had respiratory symptoms of three months duration. A few weeks prior to admission a small abscess developed over the right mastoid area. Pus from the abscess, sputum, and aspirated gastric contents showed typical B. dermatitidis by microscopic and cultural methods. No tubercle bacilli were present. The patient died May 2, 1945, eight months after onset of symptoms.—*Fig. 10, Case 10:* S.M., white, male, age 39, machinist. In April 1945 he developed a small abscess on the right ankle which was incised and drained. Subsequently he developed an abscess on the left knee and thigh, the left ear, right hand, and the right side of the face. Roentgenograms revealed a destructive bone lesion of the left knee, right ankle, and the right hand. He entered Muirdale in this condition. The chest roentgenogram revealed a few scattered calcified areas in the apex and a soft lesion in the second interspace anteriorly. Pus from the abscess and the sputum revealed the blastomyces on smear and culture. Saturated solution of potassium iodide, 30 mm., t.i.d., was started July 26, 1945, and increased rapidly to 100 mm., t.i.d., at the time of discharge August 4, 1945. He also had some roentgen therapy to the right ankle, left knee, and face. At present his general condition is excellent; he has been working as a machinist for the past three years.—*Fig. 11, Case 11:* J.S., white, male, age 30, welder. His symptoms of five weeks' duration were respiratory in nature, with a loss of 22 pounds in weight. Sputum examination revealed no tubercle bacillus but did show B. dermatitidis. He was started on saturated solution of potassium iodide and was receiving 30 mm., t.i.d. There was no apparent improvement either in his clinical or pulmonary condition. On June 30, 1947, a right lobectomy was performed. Microscopic examination of tissue from the resected lobe revealed the presence of B. dermatitidis. About three weeks postoperatively his disease disseminated with spread to the opposite lung and subcutaneous abscesses developed over various parts of his body. He died eleven months after the onset of symptoms.

SUMMARY

1) Eleven cases of systemic blastomycosis are reported. Seven are dead; four are living eight, seven, four and one-half, and three years, respectively, after the diagnosis was established.

2) Pulmonary symptoms were predominant, and except when tuberculosis coexisted with the blastomycosis, pulmonary tuberculosis was the initial diagnosis.

3) The roentgenologic appearance may simulate practically any type of pulmonary pathology. It has no particular pattern. Five of our cases showed upper lobe consolidation.

4) In two of our cases large pulmonary cavities were present; this is contrary to the usual reports.

5) Cutaneous manifestations usually are present, and should be searched for because small innocent-looking abscesses may yield the organism.

6) Sputum examination usually will reveal the blastomyces either on wet smear or culture. Animal inoculation may be necessary. In our experience it was disappointing.

7) Biopsy material should be examined carefully and the diagnosis made only when the organism is found.

8) Iodide was the drug of choice in this series.

9) One case in which pulmonary resection was performed ended fatally.

RESUMEN

1) Se refieren once casos de blastomicosis orgánica. Siete han muerto; cuatro han vivido ocho, siete, cuatro y medio y tres años, respectivamente, desde que se les hizo el diagnóstico.

2) Predominaban los síntomas pulmonares y, exceptuando los casos en los que la tuberculosis coexistía con la blastomicosis, el diagnóstico inicial fue el de tuberculosis pulmonar.

3) El aspecto roentgenográfico puede imitar casi cualquier tipo de patología pulmonar. No tiene ningun patrón especial. En cinco de nuestros casos se notó consolidación en lóbulos superiores.

4) En dos de nuestros casos había grandes cavernas pulmonares, lo que difiere de los informes usuales.

5) Por lo general, ocurren manifestaciones cutáneas y debe buscárselas, porque es posible encontrar el microbio en abscesos pequeños y aparentemente innocuos.

6) Exámenes del esputo generalmente demuestran el blastomiceto, ya en frotes húmedos o en cultivos. A veces es necesario inocular a animales, aunque en nuestra experiencia ello no ha dado buenos resultados.

7) Debe examinarse cuidadosamente el tejido obtenido en biop-

sias, y sólo debe hacerse el diagnóstico cuando se encuentre el microbio.

8) Los yoduros fueron las drogas de elección en esta serie.

9) Terminó fatalmente un caso en el que se hizo una resección pulmonar.

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Arthralgia as a First Symptom of Pulmonary Lesions*

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It is the purpose of this communication to emphasize that arthralgia may be the earliest manifestation of hypertrophic pulmonary osteoarthropathy and consequently, at times, the earliest symptom of intrathoracic disease. That clubbing of the fingers is an early manifestation of hypertrophic pulmonary osteoarthropathy was suggested by Marie[1] in 1890, Bamberger[2] in 1891, and shortly after by Lefebvre,[3] Thompson,[4] Landis,[5] and others. Locke,[6] in 1915, determined conclusively that clubbed fingers are an early phase of hypertrophic pulmonary osteoarthropathy. "Simple clubbing of the fingers and secondary hypertrophic osteoarthropathy should be considered as identical, the former representing an early stage of the latter." He reinterated that in the majority of instances hypertrophic osteoarthropathy is secondary to a primary pathological process involving the organs of the thorax.

Van Hazel,[7] in 1940, stressed the fact that joint manifestations, when occurring rapidly, in the absence of pulmonary symptoms, may be interpreted as arthritis. This error precludes an early diagnosis of the pulmonary pathology which may be a malignant neoplasm. Pain, although not always present in pulmonary osteoarthropathy, may be the first symptom of the process. This is of extreme diagnostic importance. Regarding this important point, the literature is deficient. Craig,[8] Nef,[9] Van Hazel,[7] and Pavlovsky[10] are among the few who have made the correlation.

Many cases are incorrectly treated for arthritis without the underlying pulmonary disease, frequently a tumor, being suspected. Three of Craig's[8] cases were treated for rheumatism. Six of the seven cases collected by Van Hazel[7] were treated for arthritis. Locke's[6] first case had arthritis. Nineteen months before the first recorded pulmonary symptom, an hemoptysis, occurred. This case is an excellent example of arthralgia as the first symptom of hypertrophic pulmonary osteoarthropathy due to a carcinoma of the lung. Of course, in 1915, this was of academic interest only. Nevertheless, he failed to note the diagnostic value of the symp-

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toms. It was to be 18 years before the lesion was successfully dealt with.[11]

The diagnostic importance of arthralgia as an early symptom of hypertrophic pulmonary osteoarthropathy is not mentioned in most textbooks of general medicine, monographs concerning symptom diagnosis, and treatises on chest diseases. Keller and Callender,[12] Nef, Van Hazel, Brum,[14] Pavlovsky and Poppe[13] commented on the marked, often immediate relief of arthritic phenomena following resection of the offending lesion. This was striking in one of our cases.

An attempt was made to collect cases from the literature in which arthralgia was the first manifestation. Certainly these do not represent all of them, but the difficulty of such a task is readily appreciated when it is realized that many of the authors whose cases are presented did not note the temporal relation of the arthralgia to subsequent pulmonary symptoms. The specific joints involved are not mentioned for they were multiple and varied. Many of the patients listed were completely bedridden for months because of "arthritis."

Case 1, Locke, 1915: A 32 year old white male who had arthralgia 19 months before the first pulmonary symptom, an hemoptysis, occurred. The case was proved to be a bronchiogenic carcinoma by necropsy three years and 10 months after he first sought medical attention. There was marked clubbing of the fingers, and x-ray films showed evidence of periostitis of the long bones.

Case 2, Keller and Callender, 1930: A 38 year old Philippino female who had arthralgia 12 months. Symptoms and anatomical changes in the joints subsided after resection of a perineural fibroma weighing 660 grams from the pericardium of the right chest. She had marked clubbing of the fingers and toes.

Cases 3, 4 and 5, Craig, 1937: (3) A 58 year old white female who had arthralgia for seven months before the diagnosis of a neoplasm of the lung was made by x-ray. Clubbing was noted after five months of arthralgia.

(4) A 58 year old white male who had arthralgia and swelling of the joints three months before clubbing was noted and for 11 months before a diagnosis of carcinoma of the right lung was made by bronchoscopic biopsy. He was treated for arthritis for 11 months, and denied pulmonary symptoms during the first three months of his arthralgia.

(5) A 45 year old white male who had arthralgia and swelling of the joints for eight months before the diagnosis of carcinoma of the lung was made by bronchoscopic biopsy. Clubbing was noted one month after the onset of pain and cough occurred seven months later.

Craig suggests "that investigation of the lung should not be overlooked in patients with rheumatism or with changes in the joints appearing without known causes as well as in those with acromegaly."

Case 6, Nef: An 11 year old white female who noted arthralgia and clubbing 12 months before a diagnosis of mediastinal tumor was made. Two months later a granulomatous xanthofibroma containing many lymphocytes and plasma cells was surgically removed. The patient experienced immediate dramatic relief from joint pains and fever. She had no symptoms referrable to the chest at any time.

Case 7, Brum: An 11 year old white female who had malaise, fatigability, and failure to gain weight for four months followed by arthralgia and fever. Five months from the onset of symptoms, a diagnosis of a lung tumor was made by x-ray inspection of the chest. At no time did the patient have cough, sputum, or hemoptysis. The fingers were clubbed. A circumscribed tumor was resected from the right upper lobe and proved to be a myoma of the lung with lymphocytic infiltration. The patient's symptoms responded dramatically to its removal.

Cases 8, 9, 10, 11 and 12, Van Hazel: (8) A 46 year old white female who had arthralgia for one month which recurred one year later along with noticeable clubbing and cough. A diagnosis at exploratory operation of carcinoma of the lung was made two years after the onset of initial arthralgia.

(9) A 52 year old white female with arthralgia and swelling of the joints eight months before symptoms of "pressure in the chest" and dyspnea occurred. A diagnosis of pulmonary carcinoma was proved by biopsy. There were marked clubbing of the fingers and hyperthropic pulmonary osteoarthropathy type of periostitis of the long bones of the upper and lower extremities on x-ray inspection.

(10) A 40 year old white female who complained of arthralgia, swelling and stiffness of the joints two months before the first pulmonary symptom of hemoptysis occurred. Five months after the onset, a right pneumonectomy was performed for carcinoma. There was dramatic, immediate relief of the arthralgia. Physical examination and x-ray films in this case demonstrated marked clubbing of the fingers and hypertrophic periostitis of the long bones.

(11) A 32 year old female who noted stiffness, arthralgia and swelling of the joints seven months before an anterior mediastinal fibroma weighing 610 grams was removed. This was followed by dramatic relief of arthralgia. There was marked clubbing of the fingers on physical examination.

(12) A 74 year old female who had arthralgia, swelling and clubbing of the fingers eight months before a metastatic fibrosarcoma of the lung was diagnosed by x-ray examination. Pulmonary symptoms and cough appeared 10 months after the onset of arthralgia.

Case 13, Duncan:[15] A 50 year old white male with arthralgia one year before death due to adenocarcinoma of the lung proved by biopsy. No mention was made of pulmonary symptoms. Physical examination revealed marked clubbing.

Case 14, Pavlovsky:[10] An adult male presenting symptoms of arthralgia. No pulmonary symptoms noted. Because of the patient's clubbing, a chest x-ray film was taken and an adenocarcinoma of the lung found, which was resected. There was dramatic immediate postoperative relief of pain.

Case 15, Lopez:[16] A 43 year old white male who six months before entry to the hospital suffered arthralgic pains in the hands and feet followed shortly thereafter by fever. Two months later he developed pulmonary symptoms of cough and hemoptysis. At the time of entry to the hospital he exhibited clubbing of the fingers and toes and necropsy revealed carcinoma of the right lung.

Case 16, Berg: A 51 year old white male whose first complaint was pain in the legs. A diagnosis of rheumatic fever was made and three months later a chest x-ray film revealed a circumscribed opacity in the right upper lobe. A right pneumonectomy was performed for an adenocarcinoma of the lung. There was immediate relief of arthralgia postoperatively. He exhibited minimal or no clubbing of the fingers but x-ray films of the hands and tibia showed some evidence of periostitis.

Case 17, Berg: A 12 year old white female, congenital luetic, who entered a hospital complaining of arthralgia and swelling of the feet. Clubbing of the fingers and toes was noted. The patient was treated for arthritis. On July 9, 1946, because of progression of her arthritic process, a chest x-ray film was taken in the course of a routine work-up. Evidence of a lesion in the left upper lobe was seen. There was no pulmonary complaint at any time. On September 22, 1946, after a failure of x-ray therapy and sulfarsphenamine therapy, the patient was referred here and the left lung was removed for what appeared to be a malignant tumor. Section revealed it to be a cystic granulomatous mass of questionable pathology.

Case 18, Berg: A 53 year old white male who had arthralgia and swollen joints eight months before entry to the hospital. He denied all pulmonary complaints. He had received no therapy for his arthritis and while receiving hydrotherapy, the doctor noted clubbing of his fingers and toes and had an x-ray film taken of the chest. This revealed a circumscribed shadow, 5 cm. in diameter, in the right lung which was resected with immediate dramatic improvement of the arthralgia postoperatively. There was an associated effusion in the right knee joint. The lesion proved to be a bronchiogenic carcinoma.

Case 19, Berg: A 62 year old white male coal miner who complained of headache, pain in the neck, shoulder, left arm and leg migrating to the right arm and leg, associated with an effusion of the right knee, two weeks prior to entry. There were no pulmonary symptoms whatsoever. A diagnosis of fibrositis due to dental caries was then made. The referring doctor took an x-ray film of the chest in a routine examination and a hilar shadow was discovered. At operation, an undifferentiated carcinoma of the left lung was identified. The lesion was not resectable.

Case 20, Berg: A 49 year old white male who first noted arthralgia in November, 1946. He developed pain and tenderness in both knees and ankles. Two months later he observed clubbing of the fingers. One year before entry he developed a hacking cough. He had an hemoptysis six days before admission. At operation, an inoperable carcinoma was found in the left upper lobe.

SUMMARY

Arthralgia may be the earliest symptom of intrathoracic disease. The patient who presents this complaint should have a thorough

study of his chest including x-ray inspection. The surgical removal of an intrathoracic neoplasm often may bring about dramatic relief of such arthralgia.

RESUMEN

El primer síntoma de enfermedades intratorácicas puede ser la artralgia. A todo enfermo que se queje de este síntoma debe hacérsele un examen completo del tórax, inclusive de radiografías. La excisión quirúrgica de una neoplasia intratorácica a menudo conduce al alivio espectacular de la artralgia.

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An Unusual Case of Traumatic Diaphragmatic Hernia with Successful Operation

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Numerous classifications have been proposed for diaphragmatic hernia. Most of them are of little practical value from a clinical standpoint. Harrington's[1] classification of diaphragmatic herniae into two main groups, nontraumatic and traumatic, is preferred because of its simplicity. He subdivides the traumatic group into: (1) hernia due to indirect injury to the diaphragm and usually the result of a severe crushing injury; and (2) hernia due to direct injury to the diaphragm which is usually the result of a penetrating wound. The following case falls into the latter group and is presented for two reasons: First, the two unusual openings in the diaphragm through which the stomach, colon and the omentum protruded, and second, the prolonged period of observation and clinical study in a hospital before the diagnosis was made.

CASE REPORT

A 42-year old Mexican male was admitted to the Santa Barbara General Hospital on November 21, 1946, complaining of intermittent cramp-like pains in the upper abdomen, nausea with occasional vomiting, cough, fever and chills. The patient had been confined to the county jail since October 4, 1946, at which time following a domestic quarrel, he stabbed himself twice with a knife in the left lower chest. One week later, the patient first began to notice intermittent pains in his epigastrium. The pains were cramp-like in nature, were not relieved by eating food, and at times were accompanied by the regurgitation of undigested food particularly when he forced himself to eat. The patient attributed the symptoms to the change in his usual diet. The complaints gradually increased in severity and the day before admission to the hospital, he developed a non-productive cough and complained of fever and chills. He did not complain of dyspnea at anytime.

The physical examination on admission revealed a well nourished male of normal development and good musculature. The temperature was 101 degrees F., pulse 88, and respirations 18. He coughed frequently during the examination and complained of pain in his left lower chest. Examination of the head, eyes, throat and neck was negative. The percussion note over the left lower chest was flat and the breath sounds were markedly depressed. There were two healed scars from the stab wounds in the left lower thorax in the anterior axillary line. The P.M.I. was slightly displaced to the right. The abdomen was negative throughout as was the remainder of the physical examination. Because of the findings on admission (Fig. 1), he was given 35,000 units of penicillin intramuscularly every three hours until December 22, 1946.

An x-ray study of the upper gastro-intestinal tract on admission (Fig. 2) showed no organic lesion and it was felt that the stomach was apparently distorted by changes at the base of the left lung.

The blood and urine on admission were within normal limits and the blood Kahn and Kline tests were negative. On November 23 he vomited undigested food about one hour after his noon meal. This was repeated several times within the next few days. He had daily bowel movements but complained of hard stools and constipation. Because of the persistent vomiting a Wangenstein suction apparatus was inserted on November 29, he was given glucose intravenously, and permitted nothing by mouth except small sips of water. It was necessary to follow this regime intermittently until December 9 before he was able to eat without nausea.

On December 10 an aspirating needle was inserted into the left pleural space in the posterior axillary line and 30 cc. of bloody fluid was withdrawn following which a diagnosis of traumatic hemothorax was made. Bacteriologic study of this fluid was negative for pathogenic organisms.

Since admission x-ray inspection suggested lung abscess, a bronchoscopy was performed by Dr. A. R. Olsen on December 24 with essentially negative result, except some distortion of the terminal left lower lobe bronchus and the possibility of some compressing lesion was suggested.

On January 6, 1947, following the report of acid-fast bacilli on one of three 24-hour sputum specimens, the patient was transferred to the General Hospital Tuberculosis Sanatorium. This finding was never confirmed and the acid-fast bacilli were not identified as tubercle bacilli.

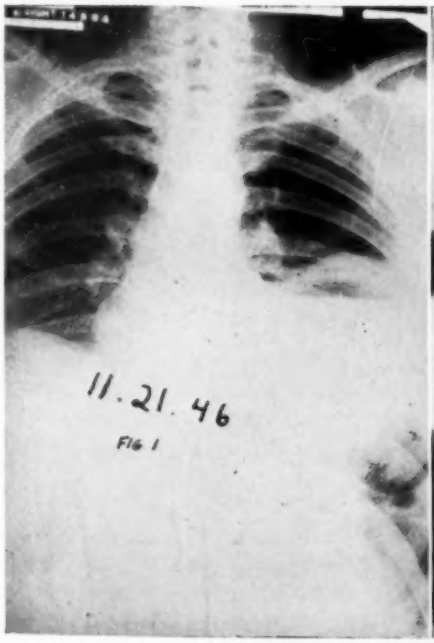

FIGURE 1

FIGURE 2

Fig. 1, P.A.: View of chest revealing evidence of fluid and air containing pocket at the base of the left lung suggestive of abscess.—*Fig. 2:* Barium study of stomach the day of admission showing no evidence of organic lesion in the upper gastro-intestinal tract.

On admission to the sanatorium 14 consecutive 24-hour sputum specimens were sent to the laboratory for concentration and culture for tubercle bacilli. All were negative. A series of gastric cultures were negative for tubercle bacilli in April, 1947. The Mantoux skin reaction was strongly positive.

Roentgenograms were taken on April 14 and July 8. The clinical diagnosis at this time was subsiding traumatic hemothorax with intense pleural reaction and elevation of the left diaphragm. During this period, the patient had been on a regime of bed rest and had improved clinically. He had gained in weight from 158 to 167 pounds. During the month of March 1947, he had two transient bouts of upper abdominal pain and vomiting. For the most part, his appetite was good and he did not complain of constipation or diarrhea. Early in the morning of July 11, he complained of severe pain in his lower abdomen and nausea. A surgical consultation was held several hours later at which time the abdomen was soft and there was no tenderness. Leucocyte counts made several hours apart were 11,700 and 6,800 per cu. mm. respectively. Clinical improvement continued and in September the patient was on outside walking exercise and considered ready for discharge.

On October 11 he had another attack of abdominal pain and vomiting, this time the pain was largely in the right upper abdomen. The complaint followed the usual pattern and subsided within a few hours. Following this, the patient was seen by one of us (F.G.P.) in the surgical clinic.

X-ray inspection of the upper gastro intestinal tract (Fig. 3) resulted

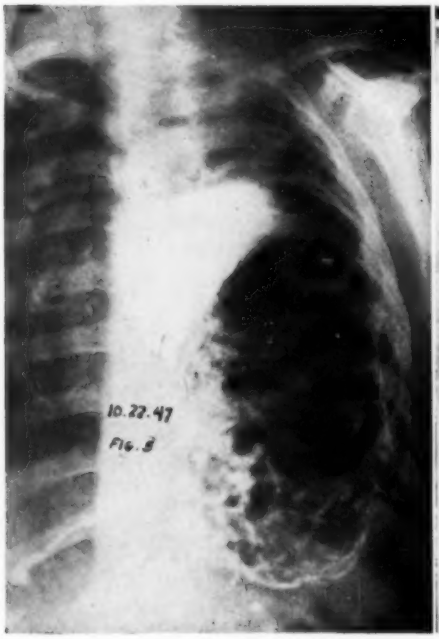

FIGURE 3

FIGURE 4

Fig. 3: Barium x-ray study of upper gastro intestinal tract taken October 22, 1947, revealing the stomach lying high in the left thorax.—*Fig. 4:* Roentgenogram taken February 17, 1948, revealing the left diaphragm in normal position and an essentially normal chest.

in a diagnosis of diaphragmatic hernia with all of the stomach and duodenal bulb above the diaphragm.

On December 12, 1947, the hernia was repaired by Dr. Joseph Robinson, chest surgical consultant. Part of the operative note follows: "The entire stomach, together with about 12 inches of large bowel and a large amount of omentum were found within the pleural cavity. There was a rent in the diaphragm measuring about four inches in length and located just mesial to the dome of the diaphragm. It extended in an antero-posterior direction, partially in line with the superior of the two scars in the chest wall. The stomach, colon and omentum were diffusely and densely adherent to the ring formed by this tear. There was also a small hole in the diaphragm measuring about one centimeter in length and located directly beneath and anterior to the two stab wound scars in the chest wall. There was about two inches of omentum protruding through this hole and it also was densely adherent to the edges. . . . The lung was entirely free from adhesions. The adhesions between the omentum, stomach and large bowel and the edges of the two diaphragmatic herniae were freed by blunt and sharp dissection. A small amount of free omentum was resected from the large mass of omentum. The bowel, stomach and omentum were then replaced into the peritoneal cavity after controlling a few bleeders following the section of the adhesions. The diaphragm was then repaired with 00 silk, using inverted mattress sutures."

The postoperative course was uneventful. There was no effusion, and it was not necessary to aspirate air from the pleural cavity. X-ray films on December 15, 1947 revealed the left lung to be completely re-expanded with slight pleural reaction at the base.

A roentgenogram (Fig. 4) was taken February 18, 1948, following which the patient was discharged from the hospital. Six months after discharge, he was free from complaints and was leading a normal life.

Comment

R. Santello[2] and R. Aquilar et al[3] describe two cases, one a diaphragmatic hernia of the stomach and the other a congenital hernia in a child, which were erroneously diagnosed as pulmonary tuberculosis. Adams and Lee[4] analyzed the symptomatology of 34 surgically treated cases of diaphragmatic hernia. The most common chief complaint was pain in the epigastrium or lower chest which occurred in 23 cases. The pain most commonly occurred soon after the ingestion of food or during meals. Vomiting often relieved the pain. Dyspnea was the second most common complaint and occurred in five patients. The remaining common complaints in order were hematemesis, constipation and regurgitation of food. The organs most often contained in the herniae of their series were the stomach and colon. The symptoms are related to the organs which have been displaced by the hernia. Lawrence[5] quoting from Harrington, refers to diaphragmatic herniae as the "Masquerader of the Upper Abdomen" because the condition is often wrongly diagnosed. He describes an auscultatory physical sign "Inspiratory Borborygmi," which made the diagnosis in one

case. The sound is only heard when the patient is lying down and is described as a "grunting borborygmus-like sound synchronous with inspiration." The sound is produced by the increased intra-abdominal pressure and the decreased intra-thoracic pressure during inspiration forcing the fluid and gaseous contents into the herniated portion of the stomach. H. Reid[6] cites a case of traumatic hernia and discusses the mechanisms by which traumatic herniae may be produced. These are direct injury, necrosis of the diaphragm by pressure from a drainage tube or rupture of a subphrenic abscess, and indirect crushing injuries. He stresses that such herniae have no sac and therefore are false herniae or eviscerations. Kiene and Copleman[7] describe a right sided hernia with delayed herniation of the liver and gall bladder. Numerous authors report the rarity of right-sided herniae. Gariepy and Dempster[8] emphasize the importance of properly using the x-ray to establish the diagnosis of diaphragmatic herniae in which the symptoms may not easily be distinguishable from other diseases of the abdomen or chest. They cite examples of patients with massive diaphragmatic herniae who passed from one physician to another without the diagnosis being made. They also quote Harrington's report of 161 cases of which 21 had been operated on previously without symptomatic relief and were completely relieved by operation. Previous diagnoses in this group included gastric and duodenal ulcer, intestinal obstruction, hyperacidity, heart disease, neoplasm of the esophagus and lung tumor. They also quote Hedblom who warns against depending entirely upon the Roentgen Ray for diagnosis since spontaneous reduction of these herniae may occur at any time thus causing them to escape detection. It must also be remembered that the herniated omentum and spleen are not seen roentgenologically.

Carter and Giuseffi[10] reviewed the literature on 39 cases of strangulated diaphragmatic hernia including two of their own and found a striking repetition of symptoms and physical findings. These included a history of a previous thoracic injury, physical findings of displacement of the heart to the right, aspiration of bloody fluid from the left pleural cavity, roentgenologic findings of a high left diaphragm, and signs of acute gastrointestinal obstruction with absence of abdominal distention and a patent intestinal tract where the stomach alone is included. All of these criteria were present in our case. First, the symptoms were those of intestinal obstruction. Second, a penetrating wound in the chest had occurred near the diaphragm. This combination of circumstances should have suggested traumatic perforation of the diaphragm and some part of the gastro-intestinal tract caught in the rent of the diaphragm. Third, an air-containing space just

above the diaphragm should lead one to consider the possibility of diaphragmatic hernia. Finally, it must be emphasized that in studying these cases the radiologist must be asked specifically to look for a diaphragmatic hernia or the correct examination may not be made. Many of these will be missed unless the patient is placed in a Trendelenburg position at the time the barium studies are made.

SUMMARY

1) A case of traumatic diaphragmatic hernia with two perforations of the diaphragm involving the stomach, transverse colon and omentum is presented.

2) Although definite criteria for suspecting the diagnosis were present, the patient was observed for 11 months in a hospital before the correct diagnosis was made.

3) Clinicians should consider the possibility of diaphragmatic hernia in all cases with obscure symptoms simulating thoracic or abdominal disease.

4) In order that a correct examination will be made, the radiologist should be asked specifically to look for a diaphragmatic hernia.

5) The treatment is surgical.

The authors wish to express their thanks and appreciation to Mr. Thomas Ogden for his assistance in making the photographic reproductions of the x-rays included in this report.

RESUMEN

1) Se refiere un caso de hernia diafragmática con dos perforaciones del diafragma incluyendo el estómago, el colon y el epiplón.

2) Aunque existía una base definida para que se hubiera sospechado el diagnóstico, el enfermo estuvo en observación en un hospital por 11 meses antes de que llegara a un diagnóstico correcto.

3) Los clínicos deben sospechar la hernia diafragmática en todos los casos con síntomas obscuros que simulen un padecimiento abdominal o torácico.

4) Para que un exámen sea hecho correctamente, debe pedirse claramente al radiólogo que busque la hernia diafragmática.

5) El tratamiento es quirúrgico.

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Cholesterol Pleural Effusion

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Cholesterol pleural effusion is a rather rare condition. It has been called by several names—cholesterol pleurisy, cholesterol-thorax, cholesterous effusion, and cholesterol pleural effusion; the latter name appears to be the best. It is a pleural effusion with cholesterol crystals in the fluid. Only 44 cases were reported in the literature up to 1929. Since then there have been 15 cases reported. The first detailed description of a case was given by T. Churton[1] in 1882. The most recent description was by Curran[2] in 1948.

The etiology remains rather obscure, but there are many theories concerning its occurrence. The fact remains that although the process of chronic pleural effusions is common, deposits of cholesterol crystals in pleural effusions are rarely encountered.

The following is the case reported:

Chief Complaint: H.W.A., a bookbindery foreman, white, 52 years of age, was admitted on April 7, 1948 with the chief complaint of shortness of breath. Three weeks before admission after walking quite strenuously, there was temperature elevation, rapid pulse and the onset of dyspnea.

A local physician was seen who prescribed treatment for a condition known as Virus "X". After three weeks he was somewhat improved and returned to work, however, he remained short of breath. Because of the persistence of symptoms, he was admitted to the hospital.

Past History: Revealed malaria and incipient tuberculosis with sanatorium treatment in 1923. No pneumothorax therapy was instituted. There has been no recurrence of active tuberculosis. In 1938, the patient had bronchiectasis and prostatitis for which he was treated with recovery. In 1940, there was an attack of pneumonia without complications. There were no operations, and no loss of weight or constitutional symptoms.

Family History: One daughter had tuberculosis which is now arrested. Mother and father both died of cancer. No nervous or mental diseases.

Physical Examination: Revealed an obese white male who was acutely ill. Temperature was 102 degrees F, pulse 120, respiration 45, and blood pressure 175/110. There was dyspnea with mild cyanosis of the lips and nailbeds. The trachea was deviated to the left. There was flatness over the whole right chest with some bronchial breath sounds at the right

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TABLE 1

BLOOD DETERMINATIONS	1948 — 4-8	4-10	4-12	4-14	4-15	4-16	4-19	4-22	4-27	5-1	5-3	5-7	5-12
Total Protein gms./100 cc.									7.43				
Serum Albumin gms./100 cc.									4.49				
Serum Globulin gms./100 cc.									2.94				
Glucose mgms./100 cc.									108				
Cholesterol mgms./100 cc.		280											
Cholesterol Esters mgms./100 cc.		190											
Urea Nitrogen mgms./100 cc.									12.8				
Sedimentation Rate mm./hour			25										12
PLEURAL FLUID													
Specific Gravity	1.030	1.025	1.024	1.022	1.022	1.022	1.020	1.020		1.021			
Total Protein gms./100 cc.		5.64									4.05		
Albumin gms./100 cc.		3.02									2.5		
Globulin gms./100 cc.		2.62									1.55		
Cholesterol mgms./100 cc.		721									150		
Cholesterol Esters mgms./100 cc.		400											
Bacterial Smear	0	0							0				
AFB Smear	0	0							0				
Bacterial Culture	0	0							0				
AFB Culture	0	0							0				
G.P. Innoculation		0											
Cholesterol Crystals	+	+	+	+	+	+	+	+	+	+	+		
Amount Aspirated cc.	500	2200	1250	650	275	650	250	175	230	225	125	0	

apex. The heart was normal except for rapid rate and accentuated second aortic sound. The prostate was boggy and enlarged. The remainder of the physical examination was normal. The blood count was normal. The erythrocytic sedimentation rate was 25 mm./hour. Urinalysis revealed only a two plus albuminuria with numerous leucocytes on the microscopic examination. The blood urea nitrogen was 12.8 mgms., the serum cholesterol was 280 mgms., and blood sugar was 108 mgms. per 100 cc. The total proteins were 7.43 gms. The serum albumin was 4.49 gms. and the serum globulin was 2.94 gms. per 100 cc. The blood Kahn was negative. A thick blood smear did not reveal malarial parasites.

Special Studies and Treatment: Thoracentesis was done on April 8, 1949, and 500 cc. of a yellowish turbid fluid was removed. The specific gravity was 1.030. Bacterial and mycobacterium tuberculosis cultures and smears were all negative. The pleural fluid revealed many cholesterol crystals and these only.

Bronchoscopy done on this day revealed only distortion of the right bronchial tree and displacement of the trachea to the left.

On April 10, 1948, a second thoracentesis was done and 2200 cc. of opalescent yellow fluid was removed. This fluid had a peculiar astringent odor. The specific gravity was 1.025. The smears and cultures were again negative, and the smear revealed again only cholesterol crystals. The pleural fluid contained a content of 721 mgms. per cent of cholesterol and 400 mgms. per cent of cholesterol esters, a total protein of 5.64 gms. per cent, an albumin content of 3.02 gms. per cent and 2.62 gms. per cent of globulin. Repeated thoracenteses were performed thereafter on April 12, 1948, when 1250 cc. of opalescent yellow fluid was removed. (On this occasion 10 cc. of methylene blue was instilled and was not recovered either in the sputum or on bronchoscopic aspirations). On April 14, 1948, 650 cc. of the same type of pleural fluid was removed. On April 15, 1948, 275 cc., one day later 650 cc., and three days later 250 cc. of yellow, orange fluid were aspirated.

During these repeated aspirations the patient regained normal breathing, and was ambulatory. On April 22, 1948, 175 cc. of yellow, orange fluid was removed. On April 27, 1948, the fluid (260 cc.) was straw colored and clear.

The next taps were done in May, the first, when 225 cc., and the third, when 125 cc. of amber colored fluid were removed.

Another bronchoscopy was done on May 3, 1948, when only less distortion of the right bronchial tree was noted.

On May 6, 1948, fluoroscopic examination revealed only a small amount of fluid covering the diaphragm which remained so until the patient's discharge on May 17, 1948.

The fluid revealed cholesterol crystals throughout the hospital stay. The laboratory examination of the fluid on May 3, 1948, showed total cholesterol 150 mgms. per cent and a total protein content of 4.05 mgms. per cent, with albumin of 2.50 gms. per cent and globulin of 1.55 gms. per cent. There were only cholesterol crystals present. The sedimentation rate on May 12, 1948, was 12 mm./hour. The patient was discharged on May 14, 1948, and since that time has enjoyed good health. He was last examined on March 12, 1949, and was found to have returned to his occupation since discharge and without any symptom or trouble. The various data have been tabulated in Table 1.

Discussion

The rarity of cholesterol pleural effusion is of great interest, especially since chronic pleural effusions are so common. Erwin[3] reported that he could only find 30 cases up to 1941, but 44 cases can be found up to 1929, and since 1929, there have been 15 more cases reported in the medical literature. Auerbach[4] in a large series of approximately 400 autopsy cases of tuberculous empyema and nontuberculous effusion or empyema at Seaview Hospital, Staten Island, New York, could not find a single case in his experience. Durham and Diamond[5] reported the first case in 26,000 admissions of pulmonary disease cases admitted to the Veteran's Administration Hospital, Oteen, North Carolina. Evander[6] and Curran[2] have reported the last cases in the literature.

The reasons that cholesterol crystals form in these fluids have been advanced by several authors. It is always associated, as with this case, with marked pleural thickening. Often, too, the pleural effusion is encysted.[17] However, the gross pressure symptoms noted in the case reported above is a rather uncommon occurrence.

In all cases the characteristic finding is the polyhedric crystals in the pleural fluid. The cholesterol content decreases with the repeated aspirations (as noted in this case).[2,7-11]

An attempt has been made to explain the presence of cholesterol crystals on the albumin-globulin ratio[7,12] in which the albumin-globulin ratio equal to, or greater than 1.0 is considered to be cholesterolytic and the cholesterol is thereby kept in solution, whereas, the albumin-globulin ratio less than one, tends to allow precipitation of the cholesterol. Review of the other cases in the literature do not appear to bear out this concept. The case reported in this article does not appear to bear out this view either. It appears that with in vitro experiments this influence of the albumin-globulin ratio is true, but it is untrue clinically.

Most of the ideas for the formation of the cholesterol crystals attribute it to local causes, in the main the alterations of the thickened pleura.[1-3,5,9,10,13-16] There are two workers[1,18] who believe that actual lipoidal degeneration of the pleura occurs which forms cholesterol crystals. Coyon[17] believed that most of the cholesterol came from the destruction of the leucocytes in the pleural fluid. Others believe that destruction of tubercle bacilli[5,19] or degeneration of caseous foci on the pleura or subpleural zone[2] results in the formation or spilling out of cholesterol. Barbieri[20] holds that the cholesterol originates from the blood and due to pleural alterations cannot be reabsorbed. The views that it is a general metabolic disturbance[8,22] do not have any evidence to support them. The local factors associated with the long standing

disease with the marked thickened pleura appear to cause the cholesterol to accumulate due to precipitation of the cholesterol already present. The greatly reduced permeability of the pleura was experimentally shown by Rouillard.[22]

Although cholesterol pleural effusion usually occurs in middle aged individuals, Sharpe[23] reported a case in a 9 year old child. The question posed by Mainini[19] that the deposition of cholesterol occurs only in the pleural cavity is incorrect, for it has been reported as occurring in the pericardium[24,25] and peritoneal cavity.[26]

That the condition is closely associated with tuberculosis appears quite evident from the literature and in the case reported in this article; this is true when even the tubercle bacilli are not recovered[2-6,8,13,15,16,21,27-29] The highest cholesterol content of pleural fluid reported was 45 grams per litre by Hedestrom.[30]

The treatment of this condition reveals itself into occasional aspirations of the pleural cavity to relieve pressure symptoms, the aspirations should lie between frequent ones and rare ones, and each case will have to be handled individually. One would recommend aspirations every three or four months, which might obviate the development of a bronchopleural fistula. Coyon[17] reported such a complication in one case. This plan of therapy appears to be satisfactory, and in our case the need for further aspirations has not occurred in over one year. It is possible that if the disease is not controlled and is troublesome either due to pressure symptoms or dyspnea or a broncho-pleural fistula, decortication or resection of the lung or both combined may be performed. It is interesting that Chaufford[11] recommended a pleurotomy if repeated aspirations were not of value.

SUMMARY

1) A case of cholesterol pleural effusion is presented.

2) The nature, etiology and treatment of the condition are discussed.

RESUMEN

1) Se presenta un caso de derrame pleural colestéarico.

2) Se discute la naturaleza, etiologia y tratamiento de este estado.

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College News

SEMI-ANNUAL MEETING, BOARD OF REGENTS

The semi-annual meeting of the Board of Regents of the College will be held at the Statler Hotel, Washington, D. C., on Monday, December 5. The Interim Session of the American Medical Association will be held in Washington, December 6 through 9.

NEXT ANNUAL MEETING

The Sixteenth Annual Meeting of the American College of Chest Physicians will be held in San Francisco, June 22 through 25, 1950. The Committee on Scientific Program for the 1950 meeting has been organized, consisting of the following physicians:

Herman J. Moersch, M.D., Rochester, Minnesota, Chairman
Osler Abbott, M.D., Atlanta, Georgia
Paul H. Holinger, M.D., Chicago, Illinois
Edwin R. Levine, M.D., Chicago, Illinois
Karl H. Pfuetze, M.D., Cannon Falls, Minnesota
Leo G. Rigler, M.D., Minneapolis, Minnesota
R. H. Sundberg, M.D., San Diego, California

Physicians interested in obtaining places on the scientific program are invited to submit titles and abstracts of their material to Dr. H. J. Moersch, Chairman of the committee, Mayo Clinic, Rochester, Minnesota.

SPECIAL ISSUE OF "DISEASES OF THE CHEST" FOR DECEMBER

The editorial staff of the College journal is preparing a special issue dealing with all phases of chemotherapy and antibiotics in the treatment of diseases of the chest. Articles by the leading authorities in the field will appear in this special issue for December 1949. Additional copies of the special issue will be available and interested physicians are requested to send in their orders early for extra copies.

EXECUTIVE SECRETARY MAKES FIELD TRIP

During an extended field trip, Mr. Murray Kornfeld, Executive Secretary of the College, held conferences with the following College officials:

Alfred A. Busse, M.D., Jefferson, Governor for Wisconsin.
Herman J. Moersch, M.D., Rochester, Minnesota, Chairman, Committee on Scientific Program.
Karl H. Pfuetze, M.D., Cannon Falls, Governor for Minnesota.
Jay Arthur Myers, M.D., Minneapolis, Editor, "Diseases of the Chest".
John F. Briggs, M.D., St. Paul, President, Minnesota Chapter.
William A. Meyer, M.D., Sanator, Governor for South Dakota.
Arthur W. Dahlstrom, M.D., Rapid City, S. D., Governor for the Indian Service.

William R. Rumel, M.D., Salt Lake City, Governor for Utah.
Ralph G. Rigby, M.D., Salt Lake City, President, Rocky Mt. Chapter.
Harold G. Trimble, M.D., Oakland, California, Chairman, Committee on Non-Surgical Collapse Therapy.
William C. Voorsanger, M.D., San Francisco, Chairman, Committee on General Arrangement for Annual Meeting.
Seymour M. Farber, M.D., San Francisco, California, Chairman, Council on Pan Pacific Affairs.
Buford H. Wardrip, M.D., San Jose, Governor for California.
C. Gerald Scarborough, M.D., San Jose, Secretary, California Chapter.
Edward W. Hayes, M.D., Monrovia, Chairman, Council on Undergraduate Medical Education.
William S. Conklin, M.D., Portland, Governor for Oregon.
Florence A. Brown, M.D., Portland, Secretary, Pacific Northwest District Chapter.
Arnold Minnig, M.D., Denver, Governor for Colorado.
Fred R. Harper, M.D., Denver, Vice-President, Rocky Mt. Chapter.
W. Bernard Yegge, M.D., Denver, Secretary, Rocky Mountain Chapter.
Allan Hurst, M.D., Denver, Chairman, Committee on Rehabilitation.
Max Fleishman, M.D., Omaha, Governor for Nebraska.
William M. Spear, M.D., Oakdale, Governor for Iowa.

The College program and special activities were discussed with the above officials.

POSTGRADUATE COMMITTEE MEETING

A special meeting was held in St. Paul, Minnesota, on Friday evening, July 15, to discuss the program for the postgraduate course on diseases of the chest to be sponsored by the Minnesota Chapter of the College in cooperation with the University of Minnesota. The course will be held on October 20, 21 and 22, at the Center for Continuation Study on the Minneapolis campus of the University.

The St. Paul members of the College were hosts at the dinner meeting. Those present were:

George N. Aagaard, M.D., Department of Postgraduate Education, University of Minnesota.
Jay Arthur Myers, M.D., Minneapolis, Regent of the College.
Karl H. Pfuetze, M.D., Cannon Falls, Governor for Minnesota.
John A. Briggs, M.D., St. Paul, President, Minnesota Chapter.
Joseph N. Gehlen, M.D., St. Paul.
Clarence Siegel, M.D., St. Paul.
George Wolf, M.D., St. Paul.
Murray Kornfeld, Chicago, Executive Secretary of the College.

MEETING OF COLLEGE MEMBERS IN SALT LAKE CITY

The members of the College in Utah assembled for an informal dinner meeting in Salt Lake City on Wednesday, July 20, as the guests of Dr. William C. Walker, and discussed the program of the College. Those present were:

William C. Walker, M.D.
William R. Rumel, M.D., Governor for Utah.
Ralph G. Rigby, M.D., President, Rocky Mountain Chapter.
Elmer M. Kilpatrick, M.D.
Murray Kornfeld, Chicago, Executive Secretary of the College.

REPORT OF MEETING HELD IN PORTLAND, OREGON

Dr. Edward W. Hayes, Chairman of the Council on Undergraduate Medical Education of the American College of Chest Physicians, accompanied by Mr. Murray Kornfeld, Executive Secretary of the College, arrived in Portland, August 2, and met that evening at the Multnomah Hotel with a group of members of the Pacific Northwest District Chapter and members of the faculty of the University of Oregon Medical School.

Dr. Hayes talked about the compilation and publication of the book "The Fundamentals of Pulmonary Tuberculosis and Its Complications," which was sponsored by the College and which he was recommending as a text for undergraduates. He also told of the proposed publication of a book covering the non-tuberculous diseases of the chest, including pulmonary manifestations of systemic disease.

Those who met with Dr. Hayes and Mr. Kornfeld were:

Dr. Charles N. Holman, Associate Professor of Medicine, Administrator and Medical Director of Hospitals and Clinics, University of Oregon Medical School.
Dr. Hance Haney, Associate Professor of Medicne.
Dr. William S. Conklin, Assistant Clinical Professor of Medicine and Surgery and Chief of Thoracic Surgery.
Dr. John E. Tuhy, Clinical Instructor in Surgery.
Dr. James T. Speros, Assistant Clinical Professor of Medicine.
Dr. Cedric Northrop, Tuberculosis Control Officer, Washington State Health Department.
Dr. Elton Watkins, Jr., Resident in Surgery, University of Oregon Medical School Hospitals and Clinics.
Dr. Florence A. Brown, Assistant Director, Division of Tuberculosis Control.

Florence A. Brown, M.D., Secretary-Treasurer,
Pacific Northwest District Chapter.

MEETING OF COLLEGE MEMBERS IN SOUTHERN CALIFORNIA

An informal open house and buffet dinner was held at the home of Dr. Edward W. Hayes in Monrovia, California on Wednesday evening, August 10. A meeting was held after dinner and Dr. Hayes spoke on the undergraduate medical education program of the College. Mr. Murray Kornfeld of Chicago, Executive Secretary of the College, gave a brief talk on the activities of the College. Those present were:

C. Norman Abbott, M.D., Ontario; Antonio Adames, M.D., Holtville; W. A. Beck, M.D., Los Angeles; Mary Block, M.D., Santa Ana; Emil Bogen, M.D., Olive View; Harry Brodsky, M.D., Los Angeles; Raymond J. Cary, M.D., Long Beach; William Coughlan, M.D., Los Angeles; J. R. Davin, M.D., Duarte; East, M.D., Duarte; T. Fred Fujikawa, M.D., Long Beach; H. Lee Fuller, M.D., Monrovia; Otto Glogauer, M.D., Long Beach;

Alfred Goldman, M.D., Beverly Hills; Edward W. Hayes, M.D., Monrovia; Edward W. Hayes, Jr., M.D., Monrovia; F. Johnson, M.D., Monrovia; William M. Kinney, M.D., Riverside; Mr. Murray Kornfeld, Chicago; E. Lundegaard, M.D., Orange; W. J. McKenna, M.D., Los Angeles; Solomon Netzer, M.D., San Fernando; Jas. O'Connor, M.D., Los Angeles; F. M. Pottenger, M.D., Monrovia; David Proctor, M.D., Pasadena; Paul Quaintance, M.D., Los Angeles; Beverly Roberson, M.D., Pasadena; J. L. Robinson, M.D., Los Angeles; David Salkin, M.D., San Fernando; J. J. Schmerler, M.D., Los Angeles; Marius Senelick, M.D., South Gate; Sidney P. Shear, M.D., Hollywood; Maurice N. Shoor, M.D., Duarte; Samuel J. Sills, M.D., Los Angeles; Jane Skillen, M.D., Olive View; R. Esmond Smith, M.D., Los Angeles; Charles A. Smolt, M.D., Ventura; Louis I. Sokol, M.D., Los Angeles; Leo Tepper, M.D., Los Angeles; Rollin D. Thompson, M.D., La Vina; Charles Ware, M.D., Pasadena; Waldo Wehrly, M.D., Santa Ana; Ruth Wells, M.D., Pasadena; and Victor M. Yespica, M.D., Caracas, Venezuela.

COMMITTEE CHAIRMEN MEET IN SAN FRANCISCO

The Chairmen of the local committees for the Sixteenth Annual Meeting of the College, to be held in San Francisco, June 22 through 25, 1950, met at the Bohemian Club in San Francisco on Tuesday evening, August 16. Arrangements for the next annual meeting were discussed. Those present were:

William C. Voorsanger, M.D., San Francisco,
Chairman, Committee on General Arrangements.
Edgar Wayburn, M.D., San Francisco,
Chairman, Committee on Publicity.
Seymour M. Farber, M.D., San Francisco,
Chairman, Committee on Registration.
Harold G. Trimble, M.D., Oakland,
Chairman, Committee on Round Tables.
Sidney Shipman, M.D., San Francisco,
Chairman, Committee on Reception.
Forrest M. Willett, M.D., San Francisco,
Chairman, Committee on Housing.
Charles Ianne, M.D., San Jose,
Chairman, Committee on Fellowship Examinations.
Glenroy Pierce, M.D., San Francisco,
Chairman, Committee on Motion Pictures.
William Van Deventer, M.D., Redwood City,
Chairman, Committee on Convocation.
A. Lincoln Brown, M.D., San Francisco,
Chairman, Committee on Transportation.
J. Lloyd Eaton, M.D., San Francisco,
Vice-Chairman, Committee on Scientific Assembly.
Martin Seid, M.D., San Francisco,
Vice-Chairman, Committee on Registration.
Buford Wardrip, M.D., San Jose,
Vice-Chairman, Committee on X-ray Conference.
Murray Kornfeld, Chicago,
Executive Secretary of the College.

College Chapter News

MEETING OF ROCKY MOUNTAIN CHAPTER MEMBERS

A meeting of the officers and members of the Rocky Mountain Chapter residing in Denver was held at the Brown Palace Hotel on Friday, August 26. Plans for the annual meeting of the Chapter, to be held in Denver on September 20 were discussed. Dr. Fred Harper, Vice-President of the Chapter, presided at the meeting. Those present were:

Arnold Minnig, M.D., Governor for Colorado; W. Bernard Yegge, M.D., Secretary, Rocky Mountain Chapter; Fred Harper, M.D., Vice-President, Rocky Mountain Chapter; Maurice Chernyk, M.D.; Leroy Elrick, M.D.; Allan Hurst, M.D.; Sidney H. Dressler, M.D.; Major Anibal Valle; Lt. Col. John M. Salyer; Robert C. Cook, M.D.; John B. Grow, M.D.; John S. Bouslog, M.D.; Casper Markel, M.D.; Werner S. Prenzlau, M.D.; and Murray Kornfeld.

SOUTHERN CHAPTER

The Southern Chapter of the College will hold its annual meeting at the Gibson Hotel, Cincinnati, Ohio, November 13 and 14, in conjunction with the meeting of the Southern Medical Association. The following program will be presented:

Sunday, November 13:

2:00 p. m. — Scientific Session:

M. Jay Flipse, M.D., F.C.C.P., Miami, Florida, Chairman, Medical Section, presiding.

"Artificial Pneumoperitoneum in the Treatment of Pulmonary Emphysema,"
James J. Calloway, M.D. and Robert H. Furman, M.D., Nashville, Tennessee.

"Treatment of Pulmonary Tuberculosis by Streptomycin and Potassiumiodide,"
Hollis E. Johnson, M.D., F.C.C.P., Raymond R. Crowe, M.D., F.C.C.P., Edgar Woody, M.D. and Roy Avery, M.D., Nashville, Tennessee.

"Spontaneous Rupture of Esophagus,"
M. Eugene Flipse, M.D., Miami, Florida.
Discussion by Osler Abbott, M.D., F.C.C.P., Atlanta, Georgia.

"Roll of Bronchoscopy in Pneumothorax Management,"
George R. Hodell, M.D., F.C.C.P., Houston, Texas.

6:30 p. m. — Cocktail Party, Gibson Hotel.

7:30 p. m. — President's Banquet, Gibson Hotel,
David H. Waterman, M.D., F.C.C.P., Knoxville, Tennessee, Toastmaster.

Presidential Address,
Dean B. Cole, M.D., F.C.C.P., Richmond, Virginia.

9:00 p. m. — X-Ray Conference, Gibson Hotel,
M. Jay Flipse, M.D., F.C.C.P., Miami, Florida, Moderator.

Members and guests are invited to bring films to the conference of patients presenting unusual diagnostic problems. Those cases which have been solved will offer the greatest interest and educational value to the membership, and will be called for first in the conference. Unsolved cases on which consultation is desired will follow.

Monday, November 14:

9:00 a. m. — Scientific Session,
Duane Carr, M.D., F.C.C.P., Memphis, Tennessee, Chairman, Surgical Section, presiding.

"Decortication of the Unexpandable Pneumothorax Lung,"
David H. Waterman, M.D., F.C.C.P. and Sheldon E. Domm, M.D., F.C.C.P., Knoxville, Tennessee.

"Middle Lobe Disease,"
J. Ray Bryant, M.D. and John S. Harter, M.D., F.C.C.P., Louisville, Kentucky.

"Chest Trauma in Civilian Practice,"
Edward Skinner, M.D., Duane Carr, M.D., F.C.C.P., Charles Kessler, M.D. and W. E. Denman, M.D., Memphis, Tennessee.

"Acquired Nonmalignant Esophago-tracheobronchial Fistulas,"
Frank Philip Coleman, M.D., F.C.C.P. and George H. Bunch, Jr., M.D., Richmond, Virginia.

12:30 p. m. — Luncheon Meeting,
Dean B. Cole, M.D., F.C.C.P., Richmond, Virginia, President, Southern Chapter, A.C.C.P., presiding.

Business Meeting, Southern Chapter.

Election of Officers.

Guest Speaker's Address:
"The Place of Pulmonary Resection in the Treatment of Pulmonary Tuberculosis,"
Norman J. Wilson, M.D., Brookline, Massachusetts.

George R. Hodell, M.D., F.C.C.P., Houston, Texas,
Chairman of luncheon.

IX CONGRESS OF U.L.A.S.T.

The following officers have been elected to preside over the IX Pan American Congress of Tuberculosis Societies, which will take place in Guayquil, Ecuador, during the latter part of July, 1951:

Presidente: Dr. Jorge A. Higgins.
Secretario: Dr. Fernando D. Gomez.
Secretario General: Dr. Marco Martínez M.
Secretario de Relaciones Exteriores: Dr. Ernesto Briones.
Secretario de Relaciones Interiores: Dr. José Durand N.
Secretario de Actas: Dr. Mayro Madero.
Secretario de Propaganda: Dr. Francisco Marchán
Secretario de Régimen Interno: Dr. Aurelio García Santos.
Tesorero: Dr. Julio Mata Martínez.

URUGUAYAN CHAPTER

The following officers of the Uruguayan Chapter were elected for the year 1949-1950:

President: Dr. Rodolfo Almeida Pintos.
Vice-President: Dr. Frederico García Capurro.
Secretary-Treasurer: Dr. Raúl Burgos.

The following members of the Chapter presented papers: Dr. Alejandro Victorica, Dr. A. Rodriguez, Professor J. M. Alonso, Dr. J. C. Barani, Dr. Aristeo Piaggio and Dr. René Racine.

CHILEAN SOCIETY OF TUBERCULOSIS

The following officers of the Chilean Society of Tuberculosis were elected for the year 1949-1950:

President: Dr. Enrique García Suárez.
Secretary: Dr. Hernán Durán M.
Treasurer: Dr. Waldimir Ancich.
Directors: Dr. César Bórquez Vial, Dr. Enrique Pereda O.

College News Notes

Dr. Elva Perez-Medina of Havana, Cuba has announced the opening of her office at Edificio Medico, 11th and K Streets, Vedado, Havana. Dr. Perez-Medina will limit her practice to diseases of the chest.

Dr. Seymour M. Farber, San Francisco, California, will lecture on "Contagious Chest Diseases—A Problem in the Practice of Dentistry" and "Recent Advances in Diagnosis and Treatment of Diseases of the Chest" at the Sixth Annual Seminar for the study and practice of dental medicine, Palm Springs, California, October 23 to 28.

Dr. J. J. Mendelsohn of Chicago, Illinois left Chicago on August 15th for an extended trip through the following European Countries: France, Switzerland and Italy. Dr. Mendelsohn left on the Queen Mary and will return on the Queen Elizabeth on October 10th.

Professor Hector Orrego Puelma, Regent of the College for Chile, presided over the III Postgraduate Course in Tuberculosis given at the Hospital del Salvador, Santiago, Chile. The following institutions participated in the postgraduate course: Servicio de Tuberculosis del Seguro Obligatorio, Instituto Bacteriológico de Chile, Servicio de Cirugía del Hospital de San José, Unidad Sanitaria de Quinta Normal, Hospital-Sanatorio "El Peral".

Dr. G. R. Kokatnur of India, recently paid a visit to the Executive Offices of the College in Chicago. Dr. Kokatnur, a graduate of the University of Minnesota, has been visiting the various medical centers in the United States of America. While in Minnesota, he visited with two of his former classmates, Dr. Jay Arthur Myers, Editor of *Diseases of the Chest* and Dr. Herman J. Moersch, Chairman of the Program Committee for the Sixteenth Annual Meeting of the College.

MANHATTAN GENERAL HOSPITAL ESTABLISHES TUBERCULOSIS UNIT

The Manhattan General Hospital, New York City, has established a completely isolated tuberculosis unit for the care of 150 patients. Dr. James S. Edlin, Medical Director of the Municipal Sanatorium of the City of New York, Otisville, is Medical Director of the new unit. The surgical division is headed by Dr. Samuel A. Thompson, who is also surgical director of the Municipal Sanatorium.

Obituary

SOLOMON BEN ASHER
1894 - 1949

Dr. Solomon Ben Asher of Jersey City, New Jersey, died of a heart attack on April 27, 1949. He had a national reputation as a heart specialist and during his lifetime had written many articles on cardiac diseases. He was born in Russia in 1894, coming to the United States during childhood, and residing in Jersey City for fifty years. He graduated in 1923 from the University and Bellevue Hospital Medical College. He was on the cardiology staff of Bellevue Hospital, New York City, and was a Visiting Physician at the Greenville Hospital, Jersey City. During World War I, he served with the Chemical Warfare Branch of the Army in Washington, D. C.

Dr. Ben Asher was a member of the International and American Gastro-enterological Associations and an Associate Fellow of the American College of Physicians, as well as a Fellow of the American College of Chest Physicians.

He was known as an inspiring and tireless worker by his friends and patients.

Irving Willner, M.D., Governor for New Jersey.